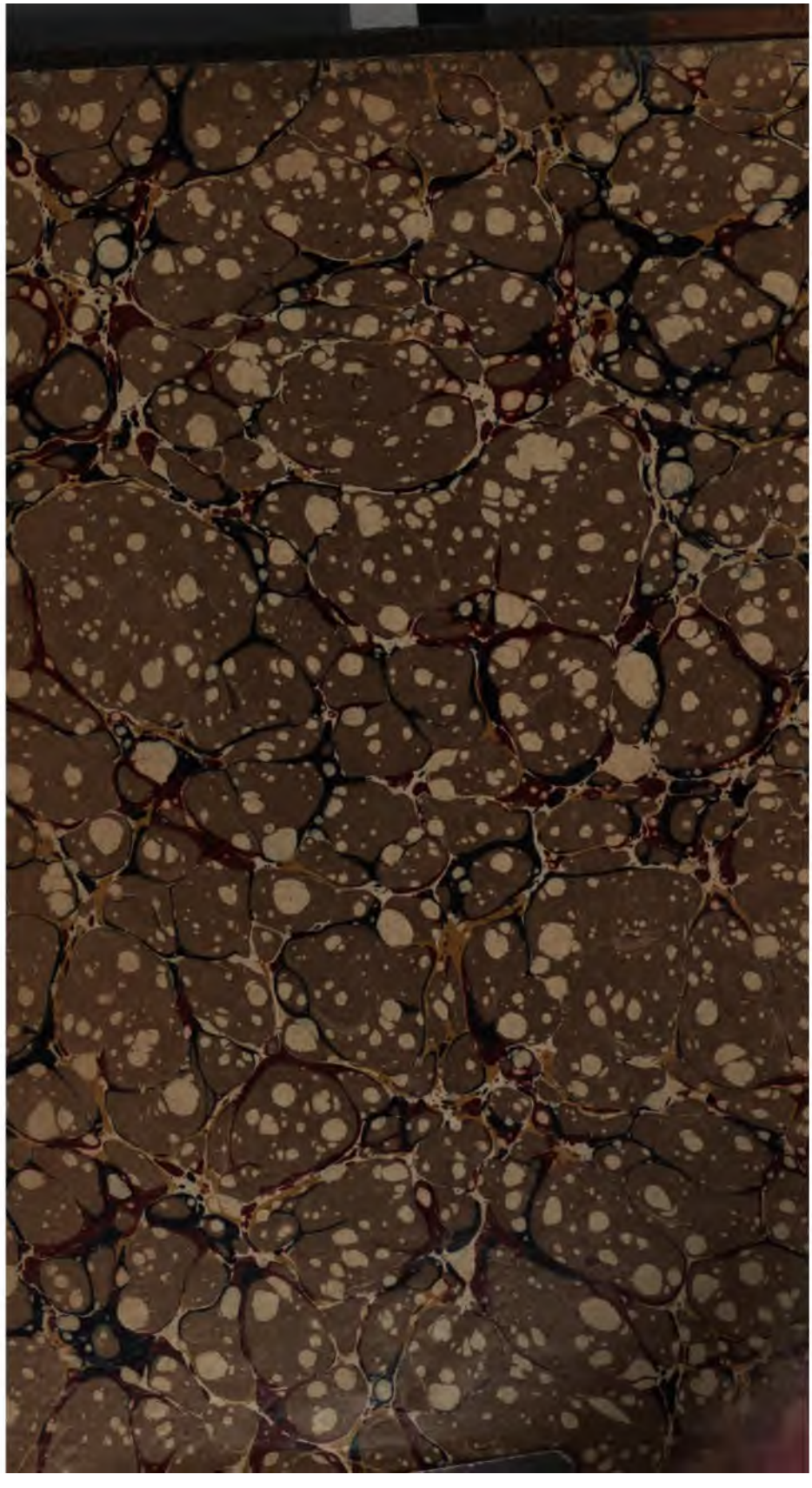

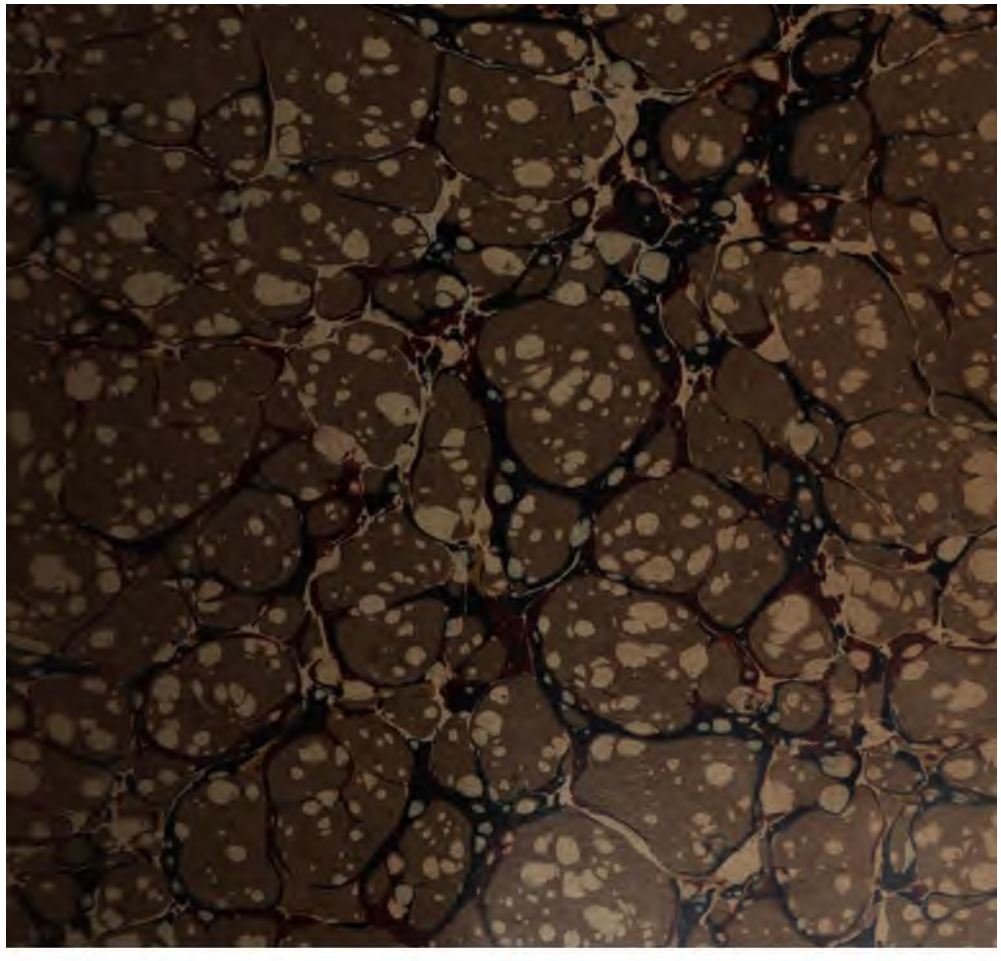

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SMITHSONIAN

MISCELLANEOUS COLLECTIONS

VOL. XLI

"EVERY MAN IS A VALUABLE MEMBER OF SOCIETY WHO BY HIS OBSERVATIONS, RESEARCHES, AND EXPERIMENTS PROCURES KNOWLEDGE FOR MEN.—SMITHSON."

CITY OF WASHINGTON
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S. P. LANGLEY,

Secretary S. I.

TABLE OF CONTENTS.

SMITHSONIAN MISCELLANEOUS COLLECTIONS.

1171

INDEX TO THE LITERATURE OF THALLIUM,

1861–1896.

BY

MARTHA DOAN.

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INDEX TO THE LITERATURE OF THALLIUM, 1861–1896,

by Miss Martha Doan.

H. CARRINGTON BOLTON, *Chairman.*

MR. S. P. LANGLEY,
Secretary of the Smithsonian Institution.

INDEX TO THE LITERATURE OF THALLIUM.

1861–1896.

BY MARTHA DOAN.

1861 : 1. W. Crookes. (Discovery.)

Chem. News, **3**, 193, 303 ; Am. J. Sci. [2], **32**, 411 ; Phil. Mag. [4], **21**, 301 ; Bull. Soc. chim., **3**, 211, 289 ; Chem. Centrbl., 1861, 496 ; N. Arch. ph. nat., **11**, 160 ; Jsb., 1861, 44, 130.

1862 : 1. A. Lamy. (Discovery, occurrence, and extraction—Properties and compounds.)

Ann. chim. phys. [3], **67**, 385, 418 ; Am. J. Sci. [2], **35**, 273 ; Compt. rend., **54**, 1255 ; **55**, 836 ; J. pharm. [3], **42**, 81 ; Ann. der. Phys. Pogg., **116**, 495 ; Ann. Chem. Liebig, **124**, 215 ; Bull. Soc. chim., **4**, 291 ; **5**, 81 ; Instit., 1862, 416 ; Phil. Mag. [4], **24**, 185 ; N. Arch. ph. nat., **14**, 400 ; **16**, 77 ; Dingl. pol. J., **165**, 284 ; Z. Chem. Phar., 1862, 428 ; J. prakt. Chem., **86**, 250 ; **88**, 172, 362 ; Chem. News, **6**, 29 ; Chem. Centrbl., 1862, 625 ; Zeit. Chem. Phar., 1863, 125 ; Jsb., 1862, 176.

1862 : 2. W. Crookes.

Proc. Roy. Soc., **12**, 150 ; Chem. News, **6**, 1 ; Am. J. Sci. [2], **34**, 275, 409 ; Pharm. J. Trans. [2], **4**, 63 ; Ann. Chem. Liebig, **124**, 203 ; J. prakt. Chem., **88**, 167 ; Chem. Centrbl., 1862, 808 ; Vierteljschr. Pharm., **12**, 60 ; Bull. Soc. chim., **4**, 404 ; Jsb., 1862.

1862 : 3. Regnault. (Specific heat.)

Comptes. rend., **55**, 887 ; Instit., 1862, 418 ; Ann. chim. phys. [3], **67**, 427 ; Ann. Chem. Liebig, **126**, 82 ; Zeit. Chem. Phar., 1863, 94 ; Bull. Soc. chim., **5**, 81 ; Jsb., 1862, 180.

1862 : 4. F. Kuhlmann. (Organic salts and estimation of Tl.)

Compt. rend., **55**, 607 ; Instit., 1862, 343 ; Ann. chim. phys. [3], **68**, 341 ; Ann. Chem. Liebig, **126**, 75 ; J. prakt. Chem., **88**, 175 ; Zeitschr. Chem. Phar., 1862, 690 ; Chem. Centrbl., 1863, 70 ; Bull. Soc. chim., **4**, 408 ; Jsb., 1862, 187.

1862 : 5. de la Provostaye. (Crystalline form of some organic salts.)

Compt. rend., **55**, 610 ; Ann. Chem. Liebig, **126**, 79 ; J. prakt. Chem., **88**, 178 ; Zeitschr. Chem. Phar., 1862, 693 ; Jsb., 1862, 187.

1863 : 1. W. A. MILLER. (Spectrum.)

Lond. R. Soc. Proc., **12**, 407; Phil. Mag. [4], **26**, 228; Chem. News, **7**, 146; N. Arch. ph. nat., **18**, 359; Ann. chim. phys. [3], **69**, 507; J. prakt. Chem., **91**, 190; Chem. Centrbl., 1864, 246; Jsb., 1863, 112.

1863 : 2. R. BÖTTGER. (Occurrence in salt waters.)

Frank. phys. Ver., 1863, 1; Ann. Chem. Liebig, **128**, 240, 368; J. prakt. Chem., **89**, 378; **90**, 145; Chem. Centrbl., 1863, 669; Jsb., 1863, 185.

1863 : 3. F. KUHLMANN. (Lead-chamber deposits.)

Compt. rend., **56**, 171; Instit., 1863, 26; Ann. chim. phys. [3], **67**, 428; Bull. Soc. chim., **5**, 122; J. prakt. Chem., **88**, 433; Dingl. pol. J., **167**, 455; Jsb., 1863, 246.

1863 : 4. A. LAMY. (Toxicological effects of Tl.)

Compt. rend., **57**, 442; Instit., 1863, 265; J. Pharm. [3], **44**, 285; Chem. Centrbl., 1864, 287; J. prakt. Chem., **91**, 366; Jsb., 1863, 255.

1863 : 5. W. T. ROEPPER. (Occurrence in furnace products.)

Am. J. Sci. [2]. **35**, 420; Jsb., 1863, 246.

1863 : 6. HERRPATH. (Occurrence in Bi.)

Trans. Pharm. J., **4**, 302; Jsb., 1863, 236, 243, 687.

1863 : 7. L. DE LA RIVE. (Specific gravity and electrical conductivity.)

Compt. rend., **56**, 588; Instit., 1863, 93; N. Arch. ph. nat., **17**, 67; Bull. Soc. chim., **6**, 270; Ann. Chem. Liebig, **128**, 128; Phil. Mag. [4], **26**, 236; J. prakt. Chem., **91**, 369; Chem. Centrbl., 1864, 404; Jsb., 1863, 249.

1863 : 8. MATTHIESSEN and VOGT. (Electrical conductivity.)

Ann. der Phys. Pogg., **118**, 431; Phil. Mag. [4], **26**, 542; Ann. Chem. Liebig, **128**, 128; Bull. Soc. chim., **6**, 270; Lond. R. Soc. Proc., **12**, 472; Jsb., 1863, 249.

1863 : 9. GASSIOT. (Spectrum.)

Lond. R. Soc. Proc., **12**, 536; Phil. Mag. [4], **27**, 143; Chem. Centrbl., 1864, 404; Jsb., 1863, 112.

1863 : 10. CROOKES. (Preparation of Tl. in large amounts.)

Chem. News, **8**, 159; Rep. chim. app., **5**, 435; J. pharm. [3], **45**, 216; Chem. Centrbl., 1864, 401; Jsb., 1863, 246, 248.

1863 : 11. CROOKES. (Priority of discovery.)

Phil. Mag. [4], **26**, 55; J. prakt. Chem., **90**, 19.

1863 : 12. W. A. MILLER. (Spectrum of Thallium.)

Lond. R. Soc. Proc., **12**, 407; Phil. Mag. [4], **26**, 228; Chem. News, **7**, 146; N. Arch. ph. nat., **18**, 359; Ann. chim. phys. [3], **69**, 507; J. prakt. Chem., **91**, 190; Chem. Centrbl., 1864, 246; Jsb., 1863, 112.

1863 : 13. R. Böttger. (Occurrence in salt water at Nauheim and ———.)

Ann. Chem. Liebig, **127**, 240, 368 ; Jour. prakt. Chem., **89**, 378 ; **90**, 145 ; Chem. Centrbl., 1863, 669 ; Jsb., 1863, 185.

1863 : 14. Erdmann.

J. prakt. Chem., **89**, 381 ; Chem. Centrbl., 1864, 403 ; Jsb., 1863, 250.

1863 : 15. Crookes and Church. (Thallium sesquichloride.)

Chem. News, **8**, 1 ; Chem. Centrbl., 1864, 411 ; Jsb., 1863, 250.

1863 : 16. Willm. (Ammonium derivatives of $TlCl_3$.)

Bull. Soc. chim., **5**, 354 ; Zeitschr. Chem. Pharm., 1863, 751 ; Chem. Centrbl., 1864, 410 ; Jsb., 1863, 251.

1863 : 17. Crookes. (Nitrate, perchlorate.)

Chem. News, **8**, 195 ; Jsb., 1863, 252.

(Phosphate, carbonate.)

Chem. News, **8**, 219 ; **8**, 231 ; Jsb., 1863, 253.

(Sulphate, chromates, acetate.)

Chem. News, **8**, 243 ; **8**, 255 ; **8**, 279 ; Jsb., 1863, 255.

(All these salts.)

Chem. Centrbl., 1864, 405 ; Zeitschr. anal. Chem., **2**, 201.

1863 : 18. R. Böttger. (New method of obtaining Tl. from flue dust. Its properties and compounds.)

Jsb. Frank. phys. Ver., 1863, 4 ; Ann. Chem. Liebig, **128**, 248 ; J. prakt. Chem., **90**, 151 ; Rep. chim. app., **5**, 485 ; Jsb., 1863, 248.

1863 : 19. Paulet. (Poisonous properties of Tl.)

Compt. rend., **57**, 494 ; Instit., 1863, 290 ; Chem. Centrbl., 1864, 287 ; Jsb., 1863, 255.

1863 : 20. Grandeau. (Poisonous properties of Tl.)

Instit., 1863, 333 ; Jsb., 1863, 256.

1863 : 21. R. Böttger. (Method of obtaining Tl. from lead-chamber deposits. Some Tl. compounds.)

Jsb. des Frank. phys. Ver., 1861–62, 58 ; Ann. Chem. Liebig, **127**, 175; J. prakt. Chem., **90**, 22 ; Vierteljahrsschr. pr. Phar., **12**, 365 ; Chem. Centrbl., 1863, 404 ; Dingl. pol. J., **168**, 438 ; Ann. chim. phys. [3], **78**, 500 ; Bull. Soc. chim., **5**, 451 ; Jsb., 1863, 45.

1863 : 22. Schrötter. (Occurrence in lepidolite and mica.)

Wien. Akad. Ber. [2], **48**, 734 ; J. prakt. Chem., **91**, 45; Chem. Centrbl., 1864, 864 ; Instit., 1864, 70 ; Chem. News, **9**, 169 ; Jsb., 1864, 245.

1863 : 23. V. v. Lang. (Crystal form and optical properties of Tl_2SO_4.)

Phil. Mag. [4], **25**, 248 ; Ann. Chem. Liebig, **128**, 76 ; Ann. der Phys. Pogg., **118**, 630 ; Bull. Soc. chim., **5**, 453 ; Chem. Centrbl., 1864, 144 ; Jsb., 1863, 254.

1864 : 1. G. WERTHER. (Determination as iodide.)

Zeitschr. anal. Chem., **3**, 1 ; J. prakt. Chem., **93**, 393 ; Chem. Centrbl., 1864, 987 ; J. Pharm. [3], **46**, 306 ; Jsb., 1864, 712.

1864 : 2. A. LAMY. (Alcoholates.)

Ann. chim. phys. [4], **3**, 373 ; Compt. rend., **59**, 780 ; Instit., 1864, 370 ; J. Pharm. [4], **1**, 211 ; Chem. News, **10**, 268 ; Chem. Centrbl., 1865, 303 ; Am. J. Sci. [2], **39**, 220 ; Jsb., 1864, 463.

1864 : 3. W. CROOKES. (Oxalates.)

Chem. News, **9**, 1 ; Bull. Soc. chim. [2], **1**, 278 ; Chem. Centrbl., 1864, 410 ; Jsb., 1864, 254.

1864 : 4. W. CROOKES. (Solubility of Tl. salts.)

Chem. News, **9**, 37 ; Bull. Soc. chim. [2], **1**, 266 ; Jsb., 1864, 256.

1864 : 5. ERDMANN. (Action of Thallium carbonate on vegetable colors.)

J. prakt. Chem., **91**, 317 ; Chem. Centrbl., 1864, 941 ; J. Pharm. [3], **46**, 463 ; Jsb., 1864, 250.

1864 : 6. SCHÖNBEIN. (Behavior of Tl. in presence of O and H_2O_2.)

J. prakt. Chem., **93**, 35 ; Bull. Soc. chim. [2], **3**, 180 ; Jsb., 1864, 170.

1864 : 7. A. SCHRÖTTER. (Separation of Li., Rb., Cs., and Tl. in lepidolite and mica.)

Wien. Akad. Ber. [2], **50**, 268 ; J. prakt. Chem., **93**, 275 ; N. Jahr. Pharm., **23**, 16, 65 ; Chem. Centrbl., 1865, 331 ; Jsb., 1864, 186.

1864 : 8. J. NICKLES. (Spectrum.)

Compt. rend., **58**, 132 ; Instit., 1864, 11 ; Bull. Soc. chim. [2], **1**, 454 ; J. prakt. Chem., **92**, 505 ; Ann. der Phys. Pogg., **121**, 336 ; Chem. Centrbl., 1864, 404 ; Chem. News, **9**, 54 ; Phil. Mag. [4], **28**, 168 ; Jsb., 1864, 246.

1864 : 9. OETTINGER. (Molybdate and wolframate.)

Zeitschr. Chem. Pharm., 1864, 440 ; J. Pharm. [3], **46**, 463 ; Jsb., 1864, 253.

1864 : 10. BISCHOFF. (Occurrence.)

Ann. Chem. Liebig, **129**, 375 ; Dingl. pol. J., **172**, 73 ; Chem. Centrbl., 1864, 815 ; Bull. Soc. chim. [2], **1**, 349 ; J. Pharm. [3], **46**, 308 ; Jsb., 1864, 245.

1864 : 11. KUHLMANN. (Thallous fluoride.)

Compt. rend., **58**, 1037 ; Bull. Soc. chim. [2], **3**, 57 ; Chem. News. **10**, 37 ; Jsb., 1864, 253.

1864 : 12. CROOKES. (Spectrum.)

Chem. News, **9**, 54 ; Jsb., 1864, 246.

1864 : 13. WERTHER.

J. prakt. Chem., **91**, 385 ; **92**, 128, 351 ; Chem. Centrbl., 1864, 737 ; Bull. Soc. chim. [2], **2**, 272 ; **3**, 58 ; J. Pharm. [3], **46**, 463 ; Chem. News, **10**, 278 ; Jsb., 1864, 246.

1864 : 14. WILLM.

Bull. Soc. chim. [2], **2**, 89 ; Jsb., 1864, 250.

1864 : 15. J. NICKLES. (Chloro- and bromo-ethers of Tl.)

Compt. rend., **58**, 537 ; Instit., 1864, 89 ; J. Pharm. [4], **1**, 22 ; Bull. Soc. chim. [2], **1**, 467 ; Chem. News, **9**, 241 ; J. prakt. Chem., **92**, 301 ; Chem. Centrbl., 1864, 412 ; Jsb., 1864, 252.

1865 : 1. WILLM.

Ann. chim. phys. [4], **5**, 5 ; Bull. Soc. chim. [2], **4**, 166 ; Zeitschr. Chem., 1865, 488 ; Jsb., 1865, 242.

1865 : 2. STRENG. (Occurrence in furnace products.)

Dingl. pol. J., **177**, 329 ; Zeitschr. Chem., 1866, 95 ; Jsb., 1865, 242.

1865 : 3. R. BUNSEN.

Ann. Chem. Liebig, **133**, 108 ; Zeitschr. Chem., 1865, 106 ; Dingl. pol. J., **175**, 244 ; Viertschr. Pharm., **14**, 592 ; Chem. Centrbl., 1866, 31 ; Ann. chim. phys. [4], **4**, 499 ; Bull. Soc. chim. [2], **3**, 418 ; Phil. Mag. [4], **29**, 168 ; Jsb., 1865, 242.

1865 : 4. REID.

Chem. News, **12**, 242 ; Zeitschr. Chem., 1866, 64 ; Jsb., 1865, 243.

1865 : 5. BUCHNER. (Fluorides.)

Wien. Akad. Ber. [2], **52**, 644 ; J. prakt. Chem., **94**, 404 ; Chem. Centrbl., 1866, 240 ; Jsb., 1865, 244.

1865 : 6. W. H. MILLER. (Crystalline form.)

Proc. Roy. Soc., **14**, 555 ; Phil. Mag. [4], **31**, 149 ; Jsb., 1865, 244.

1865 : 7. A. LAMY. (Phosphorus compounds.)

Compt. rend., **60**, 741 ; Bull. Soc. chim. [2], **4**, 193 ; Jour. Pharm. [4], **1**, 431 ; Zeitschr. Chem., 1865, 388 ; Chem. Centrbl., 1865, 597 ; Phil. Mag. [4], **29**, 379 ; Ann. chim. phys. [4], **5**, 410 ; Jsb., 1865, 246.

1865 : 8. HEBBERLING. (Estimation of Tl.)

Ann. Chem. Liebig, **134**, 11 ; Chem. Centrbl., 1865, 657 ; N. Arch. ph. nat., **23**, 113 ; Jsb., 1865, 249.

1865 : 9. A. STRECKER. (Some Thallic salts.)

Ann. Chem. Liebig, **135**, 207 ; J. prakt. Chem., **96**, 334 ; Chem. Centrbl., 1865, 881 ; J. Pharm. [4], **2**, 340 ; Phil. Mag. [4], **30**, 256 ; Chem. News, **12**, 136 ; Am. Jour. Sci. [2], **41**, 114 ; Jsb., 1865, 252.

1866 : 1. NICKLES. (Behavior toward mercury.)

J. Pharm. [4], **4**, 127 ; Jsb., 1866, 238.

1866 : 2. H. E. Roscoe. (Thallous perchloride.)

Chem. Soc. J. [2], 4, 127; Chem. News, 14, 217, 242; J. prakt. Chem., 101, 56; Zeitschr. Chem., 1866, 753; N. Arch. ph. nat., 28, 176; Jsb., 1866, 238.

1866 : 3. Birnbaum. (Action of H_2O_2 on Tl.)

Ann. Ch. u. Pharm., 138, 133; Jsb., 1866, 239.

1866 : 4. Bunsen. (Spectrum.)

Jsb., 1866, 779.

1866 : 5. Lamy. (Tl. Glass, Tl. and Pb. Glass.)

Bull. Soc. chim. [2], 5, 164; Instit., 1866, 320; Zeitschr. Chem., 1866, 251; Chem. Centrbl., 1866, 799; 1867, 432; Phil. Mag. [4], 32, 385; Jsb., 1866, 865.

1866 : 6. Debray. (Thallium phosphomolybdate.)

Bull. Soc. chim. [2], 5, 404; Zeitschr. Chem., 1866, 478; Zeitschr. anal. Chem., 5, 381; J. prakt. Chem., 100, 64; Chem. Centrbl., 1866, 880; Vierteljahrschr. pr. Pharm., 16, 425; Jsb., 1866, 794.

1866 : 7. Böttger. (Behavior of Tl. towards S. and sulphide of gold.)

Jsb. phys. Ver. Frankfurt-a-M., 1865–66, 56; Jsb., 1866, 860.

1866 : 8. Streit.

J. prakt. Chem., 100, 191; Zeitschr. Chem., 1867, 384; Chem. Centrbl. 1867, 623; Jsb., 1867, 279.

1867 : 1. Crookes. (Behavior of Tl. salts in presence of $KMnO_4$.)

Chem. News, 15; Zeitschr. Chem., 1867, 412; Bull. Soc. chim. [2], 7, 394; N. Arch. ph. nat., 29 [?], 179; Jsb., 1867, 250.

1867 : 2. Wöhler. (Preparation from pyrites.)

Ann. Ch. Pharm., 142, 263; Bull. Soc. chim. [2], 9, 462; Phil. Mag., 34, 222; Jsb., 1867, 274.

1867 : 3. Regnauld. (Amalgams.)

Compt. rend., 64, 611; Instit., 1867, 109; J. Pharm. [4], 5, 251; J. prakt. Chem., 101, 255; Zeitschr. Chem., 1867, 349; Bull. Soc. chim. [2], 8, 179; Jsb., 1867, 275.

1867 : 4. Otto. (Position among the elements.)

J. prakt. Chem., 102, 185; Bull. Soc. chim. [2], 9, 212; Jsb., 1867, 275.

1867 : 5. Carstanjen. (Thallium and its compounds.)

J. prakt. Chem., 102, 65, 129; Zeitschr. Chem., 1868, 69; Jsb., 1867, 275.

1867 : 6. Wöhler. (Thallous chloride.)

Ann. Chem. Liebig, 144, 250; J. prakt. Chem., 104, 127; Zeitschr. Chem., 1868, 124; Bull. Soc. chim. [2], 9, 463; Jsb., 1867, 281.

1867 : 7. CARSTANJEN. (Thallium acids.)

J. prakt. Chem., **101**, 55 ; Am. Jour. Sci. [2], **44**, 269 ; Jsb., 1867, 282.

1867 : 8. F. ULLEK. (Tl. molybdanoxy-fluoride.)

Ann. Chem. Liebig, **144**, 204, 320 ; Wien. Akad. Ber. [2], **55**, 767 ; J. prakt. Chem., **101**, 61; Chem. Centrbl., 1867, 977; [Wien. Akad. Anz., 1867, 108] ; N. Arch. ph. nat., **31**, 152 ; Jsb., 1867, 236.

1867 : 9. LAMY. (Thallium.)

Wien Akad. Anz., 1867, 137 ; J. prakt. Chem , **101**, 61 ; Instit., 1867, 384 ; Jsb., 1867, 921.

1867 : 10. S. MELLOR. (Tl. and Mg. alloy.)

Chem. News, **15**, 245 ; J. prakt. Chem., **103**, 508 ; Zeitschr. Chem., 1867, 475 ; Bull. Soc. chim. [2], **8**, 259 ; Jsb., 1867, 896.

1868 : 1. WÖHLER. (Oxidation of Tl. in the circuit of a galvanic current.)

Ann. Chem. Liebig, **146**, 263, 375 ; Zeitschr. Chem., 1868, 385 ; Chem. Centrbl., 1868, 889 ; Bull. Soc. chim. [2], **10**, 352 ; Jsb., 1868, 193.

1868 : 2. J. W. GUNNING. (Extraction of Thallium.)

Scheikundige bijdragen nit het Laboratorium van het Athenæum illustre te Amsterdam, I., 95 ; Arch. neerlandaises des sci. exactes et nat., III., 86 ; Zeitschr. Chem., 1868, 370 ; Zeitschr. anal. Chem., **7**, 480 ; J. prakt. Chem., **105**, 343 ; Bull. Soc. chim. [2], **10**, 359 ; Chem. News, **17**, 138 ; Jsb., 1868, 247.

1868 : 3. LAMY and DES CLOIZEAUX. (Chem., opt. and cryst. study of salts of Tl.)

Comptes. rend., **66**, 1146 ; Ann. chem. phys. [4], **17**, 310, 434 ; Jsb., 1868, 252.

1868 : 4. H. FLEMMING. (Molybdate and silicate of Tl.)

Jenaische Zeitschr. f. Med. u. Naturw., **4**, 33 ; Zeitschr. Chem., 1868, 292 ; Bull. Soc. chim. [2], **10**, 235 ; Jsb., 1868, 250.

1869 : 1. H. FIZEAU. (Heat expansion of Thallium.)

Compt. rend., **68**, 1125 ; Ann. der Phys. Pogg., **138**, 26 ; Jsb., 1869, 86.

1869 : 2. H. C. SORBY. (Borax-bead reaction for Thallium.)

Chem. News, **19**, 309 ; Ber., **2**, 337 ; Zeitschr. anal. Chem., **9**, 100 ; Jsb., 1869, 912.

1869 : 3. A. LAMY. (Thallous oxide paper as a reagent for ozone.)

Bull. Soc. chim. [2], **11**, 210 ; Zeitschr. Chem., 1869, 416 ; Chem. Centrbl., 1869, 272 ; Ber., **2**, 60 ; Zeitschr. anal. Chem., **9**, 74 ; Jsb., 1869, 194.

1869 : 4. ZSCHIESCHE. (Double sulphides of Thallium with cerium and didymium.)

J. prakt. Chem., **107**, 98.

1869 : 5. LAMY and DES CLOIZEAUX. (Chemical and optical study of Thallium salts.)
Ann. chim. phys. [4], 17, 310.

1869 : 6. ANGSTRÖM. (Thallium spectrum.)
Ann. chim. phys. [4], 18, 235.

1870 : 1. BÖTTGER. (Preservation of lustre of Thallium under water.)
Dingl. poly. J., 197, 379; Chem. Centrbl., 1870, 623; Jsb., 1870, 355.

1870 : 2. C. RAMMELSBERG. (Isomorphism of Thallium phosphate with alkali phosphates. Position among the elements.)
Ber., 3, 276; Zeitschr. Chem. [2], 6, 570; Jsb., 1870, 356; Chem. Centrbl., 1871, 14.

1870 : 3. C. RAMMELSBERG. (Iodate and some double halides of Thallium.)
Ber., 3, 360; Zeitschr. Chem. [2], 6, 606; Chem. Centrbl., 1872, 595; Jsb., 1870, 356.

1870 : 4. CHR. HANSEN. (Ethyl compounds of Thallium.)
Ber., 3, 9; Zeitschr. Chem. [2], 6, 310; Chem. Centrbl., 1870, 82; Jsb., 1870, 507.

1870 : 5. R. SCHNEIDER and K. PREISS. (Thallium sulpho-platinate.)
Ann. der Phys. Pogg., 138, 604; J. prakt. Chem. [2], 2, 162; Chem. Centrbl., 1870, 107.

1870 : 6. COSSA. (Thallium alum.)
Nuovo Cimento [2], 3, 75; Zeitschr. Chem. [2], 6, 380; Chem. Centrbl., 1870, 470.

1871 : 1. A. CORNU. (Thallium spectrum.)
Compt. rend., 73, 332; N. Arch. ph. nat., 42, 85; Phil. Mag. [4], 42, 237; Jsb., 1871, 174.

1871 : 2. R. J. FRISWELL. (Double cyanide of Thallium and platinum.)
J. Chem. Soc., 24, 461; Ann. Chem. Liebig, 159, 383; Zeitschr. Chem. [2], 7, 414; Chem. News, 23, 249; Bull. Soc. chim. [2], 16, 87; Ber., 4, 529; Chem. Centrbl., 1871, 386; Jsb., 1871, 317.

1871 : 3. MAX SCHAFFNER. (Preparation of Thallium in large amounts.)
Wien. Acad. Ber. [2], 63, 176; Chem. Centrbl., 1871, 594; Jsb., 1871, 987.

1871 : 4. F. v. KOBELL. (Occurrence in sphalerite.)
J. prakt. Chem. [2], 3, 176; J. Chem. Soc., 24, 312; Zeitschr. anal. Chem., 11, 81; Chem. Centrbl., 1871, 308.

1871 : 5. J. THOMSEN. (Heat of neutralization of Thallium oxide.)
Ann. der Phys. Pogg., 143, 354; 143, 497; Ber., 4, 309 and 588; Bull. Soc. chim. [2], 16, 63; Jsb., 1871, 104.

1871 : 6. ———. (Thallium in pigments.)

Monit. scientif., 1871, 723; Deutsch Industriezt., 1871, 418; Jsb. Chem. Tech., 1872, 7.

1872 : 1. F. Wöhler. (Preparation of metallic Thallium.)

Ann. Chem. Liebig, **164**, 74; J. Chem. Soc., **25**, 880; Bull. chim. Soc. [2], **18**, 448; Jsb. Chem. Tech., 1873, 5; Chem. Centrbl., 1872, 658; Jsb., 1872, 254.

1872 : 2. W. Crookes. (Atomic weight of Thallium.)

Proc. Roy. Soc., **20**, 475; Chem. News, **26**, 231; Ber., **5**, 940; Zeitschr. anal. Chem., **13**, 35; J. Chem. Soc., **26**, 355; Chem. Centrbl., 1873, 62; Jsb., 1872, 254.

1872 : 3. M. Jorgensen. (Thallous-thallic iodide.)

J. prakt. Chem. [2], **6**, 82; Bull. Soc. chim. [2], **18**, 312; J. Chem Soc., **26**, 475; Jsb., 1872, 254.

1872 : 4. Rammelsberg. (Isomorphism of Thallium salts with those of univalent elements.)

Ann. der Phys. Pogg., **146**, 592; J. Chem. Soc., **25**, 987.

1872 : 5. Bolton. (Thallium uranate.)

Amer. Chemist., 1872, **2**, 456; Jsb., 1872, 255.

1872 : 6. G. Spezia. (Determination of iodine in presence of chlorine by Thallous nitrate.)

Zeitschr. anal. Chem., **11**, 397; Chem. Centrbl., 1873, 183.

1873 : 1. L. de Boisbaudran. (Spectrum of Thallium.)

Compt. rend., **77**, 1152; Jsb., 1873, 152.

1873 : 2. Carnelly. (Vanadates of Thallium.)

J. Chem. Soc., **26**, 323; Ann. Chem. Liebig, **166**, 155; Ber., **6**, 74; Chem. Centrbl., 1873, 226; Jsb., 1873, 279.

1873 : 3. C. A. Valson. (Refraction of Thallium salt solutions.)

Compt. rend., **76**, 224; Gazz. chim. ital., 1873, 134; Jsb., 1873, 135.

1873 : 4. Stolba. (Separation of Thallium from flue dust. Thallium alum.)

Ber. der. Königl. böhm Ges. d. Wissen, 1873, Nov.; J. Chem. Soc., **27**, 873; Chem. Centrbl., 1874, 118; Jsb., 1873, 282.

1873 : 5. Rammelsberg. (Hypophosphite of Thallium.)

J. Chem. Soc., **26**, 2.

1873 : 6. C. Fronmüller. (Thallous cyanide.)

Ber., **6**, 1178; J. Chem. Soc., **27**, 147.

1874 : 1. Phipson. (Determination of Thallium.)

Compt. rend., **78**, 563; J. Chem. Soc., **27**, 662; Chem. Centrbl., 1874, 235; Jsb., 1874, 996.

1874 : 2. F. C. HARTWIG. (Compounds of Thallium with alcohol radicals.)

Ber., 7, 298 : J. Chem. Soc., 27, 675 : Chem. Centrbl., 1874, 296.

1874 : 3. CARIUS and FROSMÜLLER. (Thallium triethyl.)

Ber., 7, 302 ; Chem. Centrbl., 1874, 296.

1874 : 4. TH. KNÖSEL. (Iodine compounds of Thallium.)

Ber., 7, 576 and 968 : J. Chem. Soc., 27, 775.

1874 : 5. H. SCHRÖDER. (Isomorphism of Thallium and ammonium salts.)

Ber., 7, 676.

1874 : 6. TROOST and HAUTEFEUILLE. (Behavior of Thallium toward hydrogen.)

Ann. chim. phys. [5], 2, 279 ; Compt. rend., 78, 807 : Dingl. poly. J., 214, 236 : Jsb., 1874, 230.

1875 : 1. J. THOMSEN. (Thermo-chemical study of some Thallium compounds.)

J. prakt. Chem., 12, 98 : Bull. Soc. chim., 26, 150 ; Chem. Centrbl., 1875, 578 ; Jsb., 1875, 83.

1875 : 2. R. SCHNEIDER. (Thallium-sodium sulphide.)

Ann. der Phys. Pogg., 153, 588 ; J. Chem. Soc., 28, 1533.

1875 : 3. H. LESCOEUR. (Diacetate of Thallium.)

Bull. Soc. chim., 24, 516 ; Chem. Centrbl., 1876, 35.

1875 : 4. HAMMERBACHER. (Occurrence of Thallium in carnallite.)

Ann. Chem. Liebig, 176, 82 ; J. Chem. Soc., 28, 734 ; Chem. Centrbl., 1875, 230.

1875 : 5. F. HARTWIG. (Thallium in union with alcohol radicals.)

Ann. Chem. Liebig, 176, 257 ; J. Chem. Soc., 28, 1002.

1875 : 6. J. KRAUSE. (Preparation of Thallium.)

Dingl. poly. J., 217, 323 ; J. Chem. Soc., 28, 519 ; Chem. [Centrbl., 1875, 643 ; Jsb., 1875, 216.

1875 : 7. R. NIETZKI. (Preparation of Thallium.)

Arch. Pharm. [3], 7, 385 ; Chem. Centrbl., 1877, 778 ; Jsb., 1875, 216.

1875 : 8. R. BÖTTGER. (Behavior of Thallic oxide toward "Goldschwefel.")

N. Rep. Pharm., 24, 243 ; Pol. Notizbl., 33, 31 ; Chem. Centrbl., 1878, 271 ; Jsb., 1875, 216.

1876 : 1. T. E. THORPE. (Isometric relations of Thallium.)

J Chem. Soc., 29, 859 ; Ber., 9, 952 ; Chem. News, 33, 156 ; Chem. Centrbl., 1876, 466.

1876 : 2. JOHN MUIR. (Thallium chlorate.)

J. Chem. Soc., **29**, 857 ; Ber., **9**, 952 ; Chem. News, **33**, 156 ; Chem. Centrbl., 1876, 466 ; Jsb., 1876, 258.

1876 : 3. E. J. CHAPMAN. (Blowpipe reactions of Thallium.)

Phil. Mag. [2], **2**, 397 ; J. Chem. Soc., **31**, 489 ; Chem. News, **35**, 13 ; Jsb., 1876, 995.

1876 : 4. R. NIETZKI. (Preparation and determination of Thallium.)

Dingl. poly. J., **219**, 262 ; Zeitschr. anal. Chem., **16**, 472 ; Jsb., 1876, 1072 ; Jsb., 1877, 1069.

1876 : 5. C. FRONMÜLLER. (Double cyanides of Thallium.)

Inaug. dis. Marburg, 1876 ; Jsb., 1876, 316.

1877 : 1. R. J. FRISWELL and A. J. GREENAWAY. (Thallous platinocyanide.)

J. Chem. Soc., **32**, 251 ; Ber., **10**, 1858 ; Chem. News, **35**, 272 ; Bull. Soc. chim., **30**, 120 ; Chem. Centrbl., 1877, 548 ; Jsb., 1877, 314.

1877 : 2. J. J. ACKWORTH and H. E. ARMSTRONG. (Action of nitric acid on Thallium.)

J. Chem. Soc., **32**, 86.

1877 : 3. PETER CLAESSON. (Thallium mercaptide.)

J. prakt. Chem., **15**, 193 ; J. Chem. Soc., **32**, 294 ; Jsb., 1877, 519.

1877 : 4. H. KUPFERBERG. (Thallium salicyl-anilid.)

J. prakt. Chem., **16**, 434 ; J. Chem. Soc., **34**, 319 ; Jsb., 1877, 753.

1878 : 1. H. E. ROSCOE. (Density of vapor of Thallous chloride.)

Ber., **11**, 1196 ; J. Chem. Soc., **34**, 937 ; Chem. Centrbl., 1878, 594.

1878 : 2. C. FRONMÜLLER. (Some double salts of Thallous cyanide.)

Ber., **11**, 91 ; Bull. Soc. chim., **30**, 339 ; J. Chem. Soc., **34**, 394 ; Chem. Centrbl., 1878, 178 ; Jsb., 1878, 291.

1878 : 3. A. COSSA. (Thallium alum in volcanic regions.)

Acad. dei Lincei, S., III., **2** ; Gazz. chim. ital., 1878, 235 ; Zeitschr. Kryst., **2**, 509 ; Ber., **11**, 811 ; Jsb., 1878, 1225.

1878 : 4. F. W. CLARKE. (Thallous tellurate.)

Ber., **11**, 1507 ; Am. J. Sci. [3], **6**, 201 ; J. Chem. Soc., **36**, 1004.

1878 : 5. L. F. NILSON. (Thallium plato-iodo-nitrite.)

Ber., **11**, 881.

1878 : 6. T. W. SALTER. (Thallium chromates as pigments.)

Chem. News, **37**, 96 ; J. Chem. Soc., **34**, 454 ; Jsb., 1878, 291.

1878 : 7. E. SCHONE. (Oxygen compounds of Thallium and Hydrogen peroxide.)

Ann. Chem. Liebig, **196**, 58 ; Bull. Soc. chim., **29**, 538 ; Jsb., 1878, 196.

1878 : 8. G. Ciamician. (Spectrum of Thallium.)
Ber. Wien. Acad. [2], **76**, 499.

1878 : 9. Liveing and Dewar. (Spectrum of Thallium.)
Proc. Roy. Soc., **27**, 132; **27**, 350; **27**, 494; Jsb., 1878, 182.

1879 : 1. A. Ditte. (Acid Thallium nitrate.)
Compt. rend., **89**, 576; Chem. Centrbl., 1879, 722.

1879 : 2. J. Thomsen. (Thermo-chemical study of Thallium compounds.)
J. prakt. Chem. [2], **19**, 13; Jsb., 1878, 92.

1879 : 3. D. Playfair. (Occurrence of Thallium in pyrites.)
Chem. News, **39**, 245; Dingl. poly. J., **234**, 160; Jsb., 1879, 206.

1879 : 4. Gouy. (Spectrum of Thallium.)
Ann. chim phys. [5], **18**, 58.

1880 : 1. J. Thomsen. (Further thermo-chemical study of Thallium compounds.)
J. prakt. Chem., **21**, 38; **21**, 449; Chem. Centrbl., 1880, 390.

1880 : 2. L. Schucht. (Electrolytic determination of Thallium.)
Berg. u. Hüttenm. Zeit., **39**, 121; Chemikerzeit, 1880, 292; Zeitschr. anal. Chem., **22**, 241; Chem. Centrbl., 1880, 374; Jsb., 1880, 174.

1880 : 3. L. F. Nilson. (Thallium plato-iodo-nitrite.)
J. prakt. Chem. [2], **29**, 182; Chem. Centrbl., 1880, 261.

1880 : 4. Alfred Polis. (Thallium chrome alum.)
Ber., **13**, 367.

1880 : 5. Em. Schöne. (Action of oxygen on Thallium paper.)
Ber., **13**, 1508.

1881 : 1. F. Parmentier. (Thallium silico-molybdate.)
Compt. rend., **92**, 1234; J. Chem. Soc., **40**, 880.

1882 : 1. M. Schroeder. (Thallium paper as an indicator in titration with sodium sulphide.)
Berg. u. Hüttenm. Zeit., **40**, 4; Ber., **15**, 262; Chem. Tech. Jsb., 1882, 170.

1882 : 2. Ross. (Blowpipe reactions of Thallium.)
Berg. u. Hüttenm. Zeit., **40**, 459; Chem. Centrbl., 1882, 54.

1882 : 3. Rammelsberg. (Thallium phosphate.)
Sitzungsb. d. k. Preuss. Akad. d. Wissensch., 1882, 283; Ber., **15**, 2228; J. Chem. Soc., **44**, 424; Bull. Soc. chim., **39**, 64; Ann. der. Phys. Pogg. [2], **16**, 694; Chem. Centrbl., 1882, 450.

1882 : 4. O. PAVEL. (Thallium nitroso-sulphide.)
Ber., **15**, 2600 ; Jsb., 1882, 292.

1882 : 5. W. N. HARTLEY. (Spectrum of Thallium.)
J. Chem. Soc., **41**, 84.

1883 : 1. L. SCHUCHT. (Electrolytic behavior of Thallium.)
Zeitschr. anal. Chem., **22**, 490 ; Jsb., 1883, 222, 1512.

1883 : 2. J. SCHRAMM. (Occurrence and position among the elements.)
Ann. Chem. Liebig, **219**, 374 ; J. Chem. Soc., **44**, 954 ; Ber., **16**, 2662 ; Bull. Soc. chim., **41**, 646 ; Jsb., 1883, 11.

1883 : 3. DONATH and MAYRHOFER. (Affinity, atomic weight, and specific gravity of Thallium.)
Ber., **16**, 1588 ; Jsb., 1883, 26.

1883 : 4. W. SPRING. (Thallium alum.)
Ber., **16**, 2723 ; Belg. Acad. Bull. [3], **6**, 507 ; Bull. Soc. chim., **40**, 575 ; Jsb., 1883, 102.

1883 : 5. H. BECQUEREL. (Spectrum.)
Compt. rend., **97**, 71 ; Ann. chim. phys. [5], **30**, 49 ; Jsb., 1883, 244.

1884 : 1. RAMMELSBERG. (Phosphate of Thallium.)
Ann. Wied., **20**, 928 ; J. Chem. Soc., **46**, 395.

1884 : 2. R. WEBER. (Thallium pyrosulphate.)
Ber., **17**, 2502 and 2707.

1884 : 3. CARNELLEY and O'SHEA. (Melting-point of Thallic oxide.)
J. Chem. Soc., **45**, 409.

1884 : 4. B. RATHKE. (Thallium compounds with thiourea.)
Ber., **17**, 297 ; Jsb., 1884, 504.

1884 : 5. D. TOMMASI. (Heat of formation of Thallous hydrate.)
Bull. Soc. chim. [2], **41**, 444 ; Compt. rend., **98**, 812 ; Jsb., 1884, 355.

1884 : 6. A. G. PAGE. (Chlorides of Thallium.)
Ann. Chem. Liebig, **225**, 201.

1884 : 7. H. BECQUEREL. (Spectrum.)
Compt. rend., **99**, 374 ; Jsb., 1884, 291.

1884 : 8. BRIX. (Thallium chloride and iodide, and some organic salts.)
Ann. Chem. Liebig, **225**, 160.

1885 : 1. P. KULISCH. (Action of phosphine on a Thallium solution.)
Ann. Chem. Liebig, **231**, 348 ; Chem. Centrbl., 1885, 431 ; Jsb., 1885, 431.

1886 : 1. O. ZIMMERMANN. (Occurrence in commercial uranium oxide.)

Ann. Chem. Liebig, **232**, 273 ; Jsb., 1886, 267.

1886 : 2. TH. ROSENBLADT. (Thallium-cobalt nitrate.)

Ber., **19**, 25, 35 ; J. Chem. Soc., **52**, 13.

1886 : 3. E. A. WERNER. (Determination of Thallium in presence of lead.)

Chem. News, **53**, 51 ; Ber., **19**, Ref. 220 ; J. Chem. Soc., **50**, 490 ; Chem. Centrbl., 1886, 171.

1886 : 4. OSTWALD. (Electrical conductivity of Thallous hydrate.)

J. prakt. Chem. [2], **33**, 352 ; Jsb., 1886, 267.

1886 : 5. KOSMAN. (Thallium in crude zinc.)

Chem. Zeit., **10**, 762 ; J. Chem. Soc., **50**, 851.

1887 : 1. A. C. COUSINS. (Relation to gold and mercury.)

Chem. News, **55**, 241 ; Jsb., 1887, 375.

1887 : 2. H. N. WARREN. (Thallium in platinum.)

Chem. News, **55**, 241 ; Ber., **20**, R. 483 ; J. Chem. Soc., **52**, 702 ; Monit. scientif. [4], **1**, 1103 ; Chem. Centrbl., 1887, 875 ; Jsb., 1887, 2433.

1887 : 3. A. PICCINI. (Acid oxides of Thallium.)

Gazz. chim. ital., **17**, 450 ; J. Chem. Soc., **54**, 110 ; Ber., **21**, 224 ; Chem. Centrbl., 1888, 30 ; Jsb., 1887, 545.

1888 : 1. W. C. R.-AUSTIN. (Periodic properties.)

Proc. Roy. Soc., **43**, 425 ; Chem. News, **57**, 133.

1888 : 2. B. LEPSIUS. (Valence of Thallium.)

Ber., **21**, 556 ; Jsb., 1888, 455.

1888 : 3. CARNELLEY and WALKER. (Dehydration of Thallous oxide by heat.)

J. Chem. Soc., **53**, 59.

1888 : 4. G. NEUMANN. (Double salts of Thallium chloride.)

Ann. Chem. Liebig, **244**, 329 ; J. Chem. Soc., **54**, 655 ; Ber., **21**, R. 426 ; Chem. Centrbl., 1888, 710.

1888 : 5. G. NEUMANN. (Determination of Thallium.)

Ann. Chem. Liebig, **244**, 349 ; J. Chem. Soc., **54**, 529 ; Ber., **21**, 356 ; Bull. Soc. chim., **50**, 67 ; Chem. Centrbl., 1888, 730.

1888 : 6. SCHUMANN. (Extraction of Thallium from zinc.)

Ann. Chem. Liebig, **249**, 340.

1888 : 7. K. KLUSS. (Thallium dithionate.)

Ann. Chem. Liebig, **246**, 220 ; J. Chem. Soc., **54**, 1156 ; Jsb., 1888, 481.

1889 : 1. HEYCOCK and NEVILLE. (Properties of Thallium-sodium alloy.)
J. Chem. Soc., **55**, 671.

1889 : 2. W. RAMSAY. (Molecular weight of Thallium.)
J. Chem. Soc., **55**, 531.

1889 : 3. BEILSTEIN and v. BLASE. (Thallium antimoniate.)
Melanges Phys. Chim. Bull. St. Petersburg, **13**, 1 ; Chem. Centrbl., 1889, 803 ; J. Chem. Soc., **56**, 1123.

1889 : 4. W. FEIT. (Determination of Thallium.)
Zeitschr. anal. Chem., **28**, 314 ; Ber., **22**, 512 ; J. Chem. Soc., **56**, 927 ; Chem. Centrbl., 1889, 195.

1889 : 5. H. BILTZ and V. MEYER. (Vapor density of Thallium.)
Ber., **22**, 725 ; J. Chem. Soc., **56**, 673 ; Zeitschr. phys. Chem., **4**, 249 ; Chem. Centrbl., 1889, 531 ; Jsb., 1889, 127.

1889 : 6. A. CARNOT. (Volumetric determination of Thallium.)
Compt. rend., **109**, 177 ; J. Chem. Soc., **56**, 1246 ; Zeitschr. anal. Chem., **33**, 462 ; Ber., **22**, 707 ; Chem. Centrbl., 1889, 514 ; Jsb., 1889, 2424.

1889 : 7. A. BRAND. (Electrical behavior of Thallium pyrophosphate.)
Zeitschr. anal. Chem., **28**, 595.

1889 : 8. F. L. BARTLETT. (Preparation from zinc blende.)
Chem. Soc. Ind. J., **8**, 896 ; Jsb., 1889, 341.

1889 : 9. D. CARNEGIE. (Oxides and hydrates of Thallium.)
Chem. News, **60**, 113 ; Ber., **22**, 656 ; J. Chem. Soc., **58**, 109 ; Chem. Centrbl., 1889, 738 ; Jsb., 1889, 521.

1889 : 10. C. SORET and L. DUPARC. (Specific gravity of Thallium alum.)
Arch. phys. nat. Geneve, **21**, 90 ; Chem. Centrbl., 1889, 411.

1890 : 1. J. H. LONG. (Optical properties of Thallium-tartrate solutions.)
Am. J. Sci. [3], **38**, 264 ; J. Chem. Soc., **58**, 313.

1890 : 2. HEYCOCK and NEVILLE. (Physical properties of Thallium-tin alloy.)
J. Chem. Soc., **57**, 379.

1890 : 3. G. WYROUBOFF. (Some new compounds of Thallium carbonate.)
B. Mfr., **12**, 536 ; Chem. Centrbl., 1890, 575.

1890 : 4. SCHNEIDER. (Thallium-potassium sulphide.)
J. prakt. Chem. [2], **42**, 305 ; Ber., **23**, R. 681 ; J. Chem. Soc., **60**, 16.

1890 : 5. WINKLER. (Reduction of the oxide by magnesium.)
Ber., **23**, 788 ; J. Chem. Soc., **58**, 693.

1890 : 6. J. BLAKE. (Physiological action of Thallium salts.)
Compt. rend., **111**, 57 ; Ber., **23**, R. 594 ; J. Chem. Soc., **58**, 1452.

1891 : 1. RAMMELSBERG. (Thallium hypophosphate.)
Math. nat. Mitt. Sitz-Akad. Wiss., Ber., 1891, 369 ; J. Chem. Soc., **62**, 403 ; Chem. Centrbl., 1891 (2). 790.

1891 : 2. H. BAUBIGNY. (Determination of Thallium.)
Compt. rend., **113**, 544 ; Ber., **24**, R. 920 ; J. Chem. Soc., **62**, 238.

1891 : 3. SUDBOROUGH. (Action of nitrosyl chloride on Thallium.)
J. Chem. Soc., **59**, 657.

1891 : 4. BEHRENS. (Microchemical reactions of Thallium.)
Zeitschr. anal. Chem., **30**, 138 ; Chem. News, **64**, 41.

1891 : 5. LEPIERRE and LACHAUD. (Thallous chromate.)
Compt. rend., **113**, 196 ; Ber., **24**, R. 698 ; J. Chem. Soc., **60**, 1422 ; Jahrbuch, 1891, 87.

1891 : 6. H. W. B. ROOZEBOOM. (Solution of mixed crystals of Thallous and potassium chlorate.)
Zeitschr. phys. Chem., **8**, 513 ; J. Chem. Soc., **62**, 266 ; Jahrbuch, 1891, 40.

1891 : 7. J. H. LONG. (Determination of Thallium and solubility of Thallous iodide.)
J. anal. Chem., **2**, 243 ; Zeitschr. anal. Chem., **30**, 342 ; J. Chem. Soc., **60**, 1295.

1892 : 1. K. SPONHOLZ. (Volumetric determination of Thallium.)
Zeitschr. anal. Chem., **31**, 519 ; Chem. News, **67**, 187 ; Ber., **26**, R. 157.

1892 : 2. JANNASCH and ASCHOFF. (Separation of chlorine and iodine by Thallous-sulphate solution.)
Zeitschr. anorg. Chem., **1**, 248 ; Jahrbuch, 1892, 77.

1892 : 3. SEUBERT and ELTEN. (Thallous sulphite.)
Zeitschr. anorg. Chem., **2**, 434 ; Ber., **26**, R. 150 ; Jahrbuch, 1892, 82 ; J. Chem. Soc., **64**, 456 ; Zeitschr. anorg. Chem., **4**, 68.

1892 : 4. RAMMELSBERG. (Acid and normal phosphates of Thallium.)
J. prakt. Chem., **45**, 156.

1892 : 5. RAUTER. (Action of Thallous oxide on silicon tetrachloride.)
Ann. Chem. Liebig, **270**, 249.

1892 : 6. HEYCOCK and NEVILLE. (Thallium-cadmium and Thallium-lead alloys.)
J. Chem Soc., **61**, 903, 914.

1892 : 7. LEPIERRE and LACHAUD. (Thallous chromate and Thallous chloro-chromate.)

Bull. Soc. chim. [3], **6**, 230 ; J. Chem. Soc., **62**, 567.

1893 : 1. F. MAURO. (Thallium fluor-oxymolybdate.)

Atti. Roy. Accad. Lincei [5], **2**, II, 382 ; Ber., **27**, R. 109 ; Zeitschr. anorg. Chem., **6**, 338.

1893 : 2. A. JOLY. (Thallium hypophosphate.)

Compt. rend., **118**, 649 ; Zeitschr. anorg. Chem., **6**, 427 ; Bull. Soc. chim. [3], **11**, 670 ; Ber., **27**, R. 240 ; Chem. Centrbl., 1894 (1), 819 ; J. Chem. Soc., **66** (2), 282.

1893 : 3. K. SPONHOLZ. (Determination of Thallium by titration with bromine water.)

Zeitschr. anal. Chem., **31**, 519 ; Ber., **26**, R. 157 ; Zeitschr. anorg. Chem., **3**, 239.

1893 : 4. LEPIERRE. (Atomic weight of Thallium.)

Compt. rend., **116**, 580 ; Ber., **26**, R. 267 ; Bull. Soc. chim. [3], **9**, 166 ; Zeitschr. anorg. Chem., **4**, 316 ; Jahrbuch, 1893, 95 ; Chem. Centrbl., 1893, 716.

1893 : 5. HODGKINSON and FRENCH. (Action of ammonia on Thallous sulphate.)

Chem. News, **66**, 223 ; Ber., **26**, R. 183.

1893 : 6. E. GLATZEL. (Thiophosphate of Thallium.)

Zeitschr. anorg. Chem., **4**, 186 ; Ber., **26**, R. 577 ; Chem. Centrbl., 1893, 350.

1893 : 7. LEPIERRE. (Atomic weight of Thallium.)

Bull. Soc. chim. [3], **11**, 423 ; Zeitschr. anal. Chem., **33**, 135 ; Chem. Centrbl., 1894 (2), 18.

1893 : 8. PRIBRAM. Tartrate.

Monatshefte, **14**, 742.

1893 : 9. H. KAYSER. (Spectrum of Thallium.)

Chem. Zeitung, **16**, 533 ; Zeitschr. anal. Chem., **32**, 573.

1893 : 10. J. W. RETGERS. (Solubility of Thallous iodide in methyl iodide.)

Zeitschr. anorg. Chem., **3**, 346.

1893 : 11. J. W. RETGERS. (Thallous-silver nitrate for mineral separations.)

Neues Jarhb. Min. Geol., 1893, **1**, 90 ; Zeitschr. anorg. Chem., **4**, 322 ; J. Chem. Soc., **65** (2), 294 ; Chem. Centrbl., 1894, 442.

1893 : 12. WILDE. (Spectrum.)

Proc. Roy. Soc., **53**, 369 ; J. Chem. Soc., **64** (2), 525 ; Zeitschr. anorg. Chem., **5**, 399.

1893 : 13. E. SCACCHI. (Crystallographic study of Thallium fluoxy-molybdate.)

Atti. Roy. Accad. dei Lincei [5], **2**, II, 401 ; Z. Kryst, **25**, 388 ; Ber., **27**, R. 109 ; Chem. Centrbl., 1894, (1), 456.

1893 : 14. A. A. NOYES and C. W. HAPGOOD. (Isomorphism of Thallous nitrate and diphenyl nitrate.)

Chem. News, **74**, 217.

1893 : 15. W. N. HARTLEY. (Spectrum.)

J. Chem. Soc., **63**, 139.

1893 : 16. D. COCHIN. (Spectrum.)

Compt. rend., **116**, 1055 ; J. Chem. Soc., **64** (2), 402.

1894 : 1. HEYCOCK and NEVILLE. (Freezing-points of some Thallium alloys.)

J. Chem. Soc., **65**, 31 ; Ber., **27**, R. 240 ; Ber., **28**, R. 218 ; Bull. Soc., chim. [3], **12**, 515.

1894 : 2. G. GIORGIS. (Acid Thallium carbonate.)

Atti. R. Accad. dei Lincei [5], **3**, II, 104 ; Ber., **27**, R. 859 ; J. Chem. Soc., **68** (2), 316 ; Zeitschr. anorg. Chem., **8**, 404 ; Jahrbuch, 1894, 93 ; Chem. Centrbl., 1894, 773.

1894 : 3. PENFIELD and KREIDER. (Separation of minerals of high specific gravity by Thallium-silver nitrate.)

Am. Jour. Sci. [3], **48**, 141 ; Chem. Centrbl., 1894 (2), 530.

1894 : 4. H. L. WELLS and S. L. PENFIELD. (Thallium tri-iodide.)

Zeitschr. anorg. Chem., **6**, 312 ; J. Chem. Soc., **66** (2), 318 ; Jahrbuch, 1894, 92 ; Am. Jour. Sci. [3], **47**, 463 ; Ber., **27**, R. 494 ; Chem. Centrbl., 1894 (2), 8.

1894 : 5. OTTO VOGEL. (Occurrence and spectrum of Thallium.)

Zeitschr. anorg. Chem., **5**, 49 ; Zeitschr. anorg. Chem., **5**, 61.

1894 : 6. R. SCHARIZER. (Crystallographic examination of Thallium tartrate.)

Zeitschr. Kryst., **23**, 565 ; Chem. Centrbl., 1894 (2), 1034 ; Chem. Centrbl., 1895 (2), 71.

1895 : 1. ANTONIO CURCI. (Biological action of Thallium.)

Annal. Chim. Farm., **22**, 481 ; Chem. Centrbl., 1895, 838 ; Chem. Centrbl., 1896, 120.

1895 : 2. J. H. PRATT. (Double halides of Thallium with metals of the alkalies.)

Zeitschr. anorg. Chem., **9**, 19 ; Am. J. Sci. [3], **49**, 397 ; J. Chem. Soc., **68** (2), 398 ; Chem. Centrbl., 1895, 7.

1895 : 3. A. STAVENHAGEN. (Thallium arsenite.)

J. prakt. Chem. [2], **51**, 1 ; J. Chem. Soc., **68** (2), 218.

1895 : 4. INGLESTRÖM. (Occurrence in hæmatite.)

Zeitschr. Kryst., **25**, 94 ; J. Chem. Soc., **68** (2), 505.

1895 : 5. J. A. KRENNER. (Occurrence in lorandite.)

Math. nat. Ber. Ungarn., **12** ; Chem. News., **71**, 91.

1896 : 1. L. M. DENNIS, M. DOAN, and A. C. GILL. (Thallous trinitride, Thallous-thallic trinitride, Thallous tellurate, and Thallous cyanplatinite.)

J. Amer. Chem. Soc., **18**, 970 ; Chem. Centrbl., 1897 (1), 16.

1896 : 2. J. W. RETGERS. (Double nitrate of Thallium with silver, lead, and mercury.)

Jahrb. f. Mineral., 1896 (2), 183 ; Chem. Centrbl., 1897 (1), 71.

1896 : 3. H. BILTZ. (Density of Thallium.)

Ber. d. Königl. Preuss. Akad., **5**, 67 ; Ber., **29** (4), 161.

1896 : 4. H. BILTZ. (Molecular weight of Thallium.)

Zeitschr. phys. Chem., **19**, 385.

1896 : 5. J. ANTIPOW. (Occurrence in iron pyrites.)

J. Russ. phys. chem. Ges., 1896 (1), 384. ; Ber., **29**, Ref. 1042.

AUTHOR INDEX.

SMITHSONIAN MISCELLANEOUS COLLECTIONS.

1173

INDEX TO THE LITERATURE

OF

ZIRCONIUM.

BY

A. C. LANGMUIR, PH.D.,

AND

CHARLES BASKERVILLE, PH.D.

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The Committee on Indexing Chemical Literature, appointed in 1882 by the American Association for the Advancement of Science, unanimously recommends for publication by the Smithsonian Institution the following:

INDEX TO THE LITERATURE OF ZIRCONIUM,

by A. C. Langmuir, Ph.D., and Charles Baskerville, Ph.D.

H. CARRINGTON BOLTON,
Chairman.

MR. S. P. LANGLEY,
Secretary of the Smithsonian Institution.

PREFACE.

An "Index to the Literature of Zirconium" was begun independently by the two authors. Learning of this, and in order to avoid further unnecessary duplication, it was decided to combine the references then on hand and to divide the remaining labor. The resulting product is thought to contain most of the important references to the element, and is offered to the Committee of the American Association for the Advancement of Science on Indexing Chemical Literature in hopes of its proving of value. The references are brought up to January 1st, 1899.

Besides our private libraries, we have sought references to the subject in the libraries of Columbia, Johns Hopkins, and the North Carolina Universities and the North Carolina Geological Survey. To the gentlemen in charge of these libraries we wish to extend our thanks for their courtesy and co-operation.

A. C. LANGMUIR,
C. BASKERVILLE.

APRIL, 1899.

INDEX TO THE LITERATURE OF ZIRCONIUM.

1789-1899

BY A. C. LANGMUIR AND CHARLES BASKERVILLE.

1789 : 1. KLAPROTH. (Discovery.)
Klaproth's Beiträge, **1**, 203 ; Chem. Ann. (Crell), **1**, 7 : Ann. chim. phys., **1**, 238 ; J. des Curieux de la Nature de Berlin.

1792 : 2. GMELIN. (Constituents of Zircon.)
Chem. Ann. (Crell), **1**, 99–108.

1795 : 3. KLAPROTH. (Occurrence in hyacinth.)
Klaproth's Beiträge, **1**, 227.

1797 : 4. VANQUELIN. (Researches.)
Ann. chim. phys., **22**, 179–210, **30**, 81 ; J. des Mines, **5**, 97.

1797 : 5. GUYTON. (Occurrence in hyacinth.)
Ann. chim. phys., **21**, 72–95.

1799 : 6. GUYTON. (Behavior on fusion with silica and chalk.)
Ann. chim. phys., **31**, 259.

1799 : 7. TROMMSDORFF. (Futile efforts to reduce Zirconium dioxide.)
Ann. chim. phys., **29**, 223.

1803 : 8. KLAPROTH. (Analysis Zirconia.)
Phil. Mag., **17**, 237.

1807 : 9. KLAPROTH. (Further researches.)
Gehlen, J., **4**, 386–394.

1808 : 10. DAVY. (Attempt to decompose Zirconia.)
Phil. Mag., **32**, 203–7.

1818 : 11. BERZELIUS. (Comparison with thorium.)
Afh. Fys. Kemi, **5**, 86 ; J. für Chem. (Schweigger), **21**, 25.

1819 (?) : 18. HARE. (Fusion of Zircon.)
Am. J. Sci., **2**, 292.

1820 : 19. PFAFF. (Reactions. Similarity to titanium.)
J. für Chem. (Schweigger), **28**, 102.

1820 : 20. CHEVREUL. (Reactions. Separation from iron. Comparison with titanium. Double potassium salt.)
Ann. chim. phys. [2], **13**, 245–9 ; J. für Chem. (Schweigger), **29**, 144 ; J. de Phys., **90**, 170–5 ; Oken. Isis. (1821), 524–26 ; Phil. Mag., **55**, 377–9 ; Trommsdorff, N. J. de Pharm., **5**, 214–221.

1820 : 21. DUBOIS and SILVEIRA. (Preparation pure Zirconia. Separation from iron.)
Ann. chim. phys. [2], **14**, 110 ; Phil. Mag. [1], **55**, 377–9.

1822 : 22. STROMEYER. (Presence in eudialith.)
Berzelius' Jsb., **1**, 40.

1823 : 23. BERZELIUS. (Silicofluoride.)
Ann. der Phys. (Pogg.), **1**, 23, 197 ; Sv. Vet. Akad. Handl., 1823, 284 ; Am. J. Sci., **9**, 377.

1824 : 24. BERZELIUS. (Researches. Preparation.)
Sv. Vet. Akad. Handl., 1824, 295 ; Ann. der Phys. (Pogg.), **4**, 117–45 ; J. für Chem. (Schweigger), **21**, 40 ; Berzelius' Jsb., **5**, 106–12 ; Ann. chim. phys. [2], **26**, 43 ; J. de Pharm. [2], **10**, 461 ; Mag. für Pharm. (Geigers), **12**, 295 ; Phil. Mag., **64**, 393.

1825 : 25. BERZELIUS. (Properties of salts.)
Ann. chim. phys. [2], **29**, 337.

1826 : 26. BERZELIUS. (Separation from titanium.)
Ann. der Phys. (Pogg.), **6**, 231–2 ; Berzelius' Jsb., **5**, 139.

1826 : 27. BERZELIUS. (Sulphotungstate.)
Ann. der Phys. (Pogg.), **8**, 279.

1826 : 28. BERZELIUS. (Sulpharsenate.)
Ann. der Phys. (Pogg.), **7**, 24, 144 ; Berzelius' Jsb., **6**, 194.

1826 : 29. BERZELIUS. (Sulphomolybdate.)
Ann. der Phys. (Pogg.), **7**, 273 ; Berzelius' Jsb., **6**, 197.

1826 : 30. BERZELIUS. (Atomic weight.)
Ann. der Phys. (Pogg.), **8**, 186.

1827 : 31. BERZELIUS. (Atomic weight.)
Ann. der Phys. (Pogg.), **10**, 341.

1828 : 32. SPRENGEL. (Presence in plants.)
J. techn. Chem., **3**, 314.

1830 : 33. BERTHEMOT. (Bromide.)
Ann. chim. phys. [2], **44**, 393.

1831 : 34. BERZELIUS. (Vanadinate.)
Ann. der Phys. (Pogg.), **22**, 58.

1832 : 35. BECQUEREL. (Electro-chemical decomposition.)
Ann. chim. phys., **48**, 337–53 ; Mém. de l' Inst. (Paris), **12**, 581–97.

1832 : 36. BERTHIER. (Preparation.)
Ann. chim. phys., **50**, 362, 375 ; Ann. Chem. (Liebig), **5**, 246, 258 ; Pharm. Centrbl., **3**, 528, 529.

1833 : 37. BERZELIUS. (Atomic weight.)
Pharm. Centrbl., **4**, 3.

1833 : 38. TROMMSDORFF. (Valerianate.)
Ann. der Phys. (Pogg.), **29**, 159.

1834 : 39. BERZELIUS. (Atomic weight.)
Pharm. Centrbl., **5**, 2.

1834 : 40. BERZELIUS. (Tellurate.)
Ann. der Phys. (Pogg.), **32**, 594.

1834 : 41. BERZELIUS. (Tellurite.)
Ann. der Phys. (Pogg.), **32**, 607.

1835 : 42. BALARD. (Behavior with bromine.)
Pharm. Centrbl., **6**, 350.

1835 : 43. BERZELIUS. (Atomic weight.)
Pharm. Centrbl., **6**, 2.

1835 : 44. BERZELIUS. (Pyroracemate.)
Ann. der Phys. (Pogg.), **36**, 18 ; Pharm. Centrbl., **7**, 42.

1840 : 45. ROSE. (Precipitation.)
Ann. der Phys. (Pogg.), **48**, 575 ; Pharm. Centrbl., **11**, 98.

1843 : 46. BERTHIER. (Separation from iron.)
Ann. chim. phys. [3], **7**, 74 ; Pharm. Centrbl., **14**, 382.

1843 : 47. SCHEERER. (Occurrence in wöhlerite. Separation.)
Ann. der Phys. (Pogg.), **59**, 327–36.

1843 : 48. SCHEERER. (Preparation pure Zirconia.)
Ann. der Phys. (Pogg.), **59**, 481 ; Berzelius' Jsb., **24**, 106, 107 ; Pharm. Centrbl., **14**, 687.

1844 : 49. HERMANN. (Preparation. Salts.)
J. prakt. Chem., **31**, 75–89 ; Pharm. Centrbl., 1844, 193–8 ; Ann. Chem. (Liebig), **52**, 240 ; Berzelius' Jsb., **25**, 147.

1845 : 50. SCHEERER. (Occurrence in Norway.)
Ann. der Phys. (Pogg.), **65**, 300.

1845 : 51. SVANBERG. (A new earth, norium, in Zirkon.)

Oefvers. K. Vetensk. Akad. Förhandlung, 1845, 34; Ann. der Phys. (Pogg.), **65**, 317–9; Berzelius' Jsb., **25**, 149; Am. J. Sci. [2], **1**, 257; Chem. Gaz., 1845, 411.

1847 : 52. HENNEBERG. (Phosphorescence. Analysis.)

J. prakt. Chem., **38**, 508–10; Pharm. Centrbl., 1847, 22, 23.

1848 : 53. DAMOUR. (Properties of some salts.)

Ann. chim. phys. [3], **24**, 87–93.

1849 : 54. MUSPRATT. (Selenite.)

J. Chem. Soc. (Lond.), **2**, 68.

1850 : 55. SJÖGREN. (Analysis. Kataplеüt.)

Ann. der Phys. (Pogg.), **79**, 300; Chem. Centrbl., 1850, 426; Phil. Mag. [3], **37**, 235; Arch. ph. nat., **14**, 154; Jsb., 1850, 738.

1850 : 56. RIVOT. (Separation from iron.)

Ann. chim. phys. [3], **30**, 188; Ann. Chem. (Liebig), **78**, 212; J. prakt. Chem., **51**, 338; Chem. Centrbl., 1850, 908; Jsb., 1850, 599.

1852 : 57. MAZADE. (Occurrence in spring-water.)

Compt. rend., **34**, 952; Jsb., 1852, 757.

1852 : 58. SJÖGREN. (Peculiarity of Zirconia from kataplеüt.)

Ann. der Phys. (Pogg.), Ergänz., **3**, 465; J. prakt. Chem., **55**, 298; Jsb., 1853, 349.

1853 : 59. BERLIN. (Researches. Existence of norium denied.)

J. prakt. Chem., **58**, 145–8; Am. J. Sci., [2], **16**, 412, 413; Jsb., 1853, 349, 350.

1853 : 60. HENRY. (Occurrence in spring-water.)

J. de Pharm. [3], **24**, 305; Jsb., 1853, 674.

1853 : 61. FRÉMY. (Sulphide.)

Ann. chim. phys. [3], **38**, 326; Compt. rend., **36**, 178; Chem. Centrbl., **24**, 114; Jsb., 1853, 328.

1854 : 62. BRUSH. (Qualitative test.)

Am. J. Sci. [2], **18**, 415; J. prakt. Chem., **62**, 6–9; J. de Pharm. [3], **26**, 154; Chem. Centrbl., **25**, 495.

1854 : 63. DAUBREE. (Artificial production of Zircon.)

Compt. rend., **39**, 153; Instit., 1854, 241; J. prakt. Chem., **63**, 1; Phil. Mag. [4], **19**, 315; Jsb., 1854, 9.

1855 : 64. SCHRÖTTER. (Occurrence in zoisite.)

J. prakt. Chem., **64**, 316–9; Sitzl. akad., Wien., **14**, 352–7; Chem. Centrbl., **26**, 224; Jsb., 1854, 822.

1855 : 65. FORBES. (Occurrence in alvit.)
J. prakt. Chem., **66**, 446.

1856 : 66. CHANDLER. (Analysis.)
Inaug. Dissert., Göttingen.

1857 : 67. WARREN. (Double sulphate with potassium.)
Ann. der Phys. (Pogg.), **102**, 449–53 ; Jsb., 1857, 158.

1857 : 68. DEVILLE and TROOST. (Comparison with titanium.)
Compt. rend., **45**, 821.

1857 : 69. DEVILLE and TROOST. (Chloride vapor-density.)
Compt. rend., **45**, 821 ; Ann. chim. phys. [4], **5**, 117 ; Ann. Chem. (Liebig), **105**, 217 ; Phil. Mag. [4], **15**, 459 ; Instit., 1857, 280 ; Arch. ph. nat. [2], **1**, 191 ; Jsb., 1857, 11, 12.

1858 : 70. DEVILLE and CARON. (Artificial preparation of Zircon.)
Compt. rend., **46**, 764 ; Ann. Chem. (Liebig), **108**, 56 ; Ann. chim. phys. [4], **5**, 109 ; Instit., 1858, 133 ; Rep. chim. pure, **1**, 16 ; J. prakt. Chem., **74**, 157 ; Jsb., 1858, 2.

1859 : 71. MALLET. (Metal. Nitride.)
Am. J. Sci. [2], **28**, 349–54 ; A. A. A. S. Proc., 1859, 217–20 ; Ann. Chem. (Liebig), **113**, 362 ; J. de Pharm. [3], **37**, 233 ; Rep. chim. pure, **2**, 160 ; Chem. Centrbl., 1860, 94 ; Jsb., 1859, 145.

1859 : 72. POTYKA. (Opening up Zircon.)
Jsb., 1859, 277.

1859 : 73. DEVILLE. (Vapor density of chloride.)
Compt. rend., **45**, 821 ; Ann. chim. phys. [3], **58**, 281, 282 ; Ann. der Phys. (Pogg.), **108**, 639 ; Jsb., 1859, 150.

1859 : 74. STROHMEYER. (Separation from iron.)
Ann. Chem. (Liebig), **113**, 127 ; Chem. Centrbl., 1860, 285 ; Jsb., 1859, 678.

1859 : 75. G. ROSE. (Isomorphism with silica.)
Ann. der Phys. (Pogg.), **107**, 602–4 ; Chem. News, **1**, 131 ; Jsb., 1859, 151.

1860 : 76. MARIGNAC. (Fluoride. Researches. Norium.)
Compt. rend., **50**, 952–5 ; Ann. chim. phys. [3], **60**, 257–99 ; Ann. Chem. (Liebig), **116**, 359 ; Arch. ph. nat. [2], **8**, 121–5 ; Rep. chim. pure, **3**, 39 ; Phil. Mag., [4], **20**, 87 ; J. prakt. Chem., **80**, 426 ; Chem. Centrbl., 1860, 603–5 ; Jsb., 1860, 134–40.

1861 : 77. NORDENSKJÖLD. (Crystalline form of oxide.)
Ann. der Phys. (Pogg.), **114**, 625, 626 ; J. prakt. Chem., **85**, 431 ; Jsb., 1861, 201.

1861 : 79. DEVILLE. (Artificial production of Zircon.)

Compt. rend., **52**, 780; Rep. chim. pure, **3**, 219; Instit., 1861, 141; J. prakt. Chem., **86**, 35; Ann. Chem. (Liebig), **120**, 176; Chem. News, **5**, 57; Phil. Mag. [4], **21**, 496, 497; Chem. Centrbl., 1862, 660; Jsb., 1861, 2, 3.

1864 : 80. PISANI. (Separation from titanium. Determination.)

Compt. rend., **57**, 298; Ztschr. anal. Chem., **4**, 416, 417; Chem. News, **10**, 91, 218; Bull. Soc. chim. (Paris), **2**, 353, 354; Chem. Centrbl., 1865, 289–91.

1864 : 81. NYLANDER. (Existence of two earths in Zirconia.)

Acta Universitatis Lundensis.

1865 : 82. TROOST. (Metal.)

Compt. rend., **61**, 109; Instit., 1865, 226; Bull. Soc. chim. (Paris), **5**, 212; Arch. ph. nat., **24**, 376; Ann. Chem. (Liebig), **136**, 349; J. prakt. Chem., **97**, 171; Chem. News, **12**, 45; Monit. sci. (Quesneville), **7**, 752; Ztschr. Chem., 1865, 561; Phil. Mag. [4], **30**, 257; Am. J. Sci. [2], **50**, 261; Jsb., 1865, 182–4.

1865 : 83. HERMANN. (Composition of minerals.)

J. prakt. Chem., **95**, 123; Chem. Centrbl., 1865, 735.

1865 : 84. DEVILLE and CARON. (Artificial production crystallized Zirconia.)

Ann. chim. phys. [4], **5**, 109, 117.

1865 : 85. PHIPSON. (Preparation of metal.)

Compt. rend., **61**, 745; J. prakt. Chem., **96**, 447; Bull. Soc. chim. (Paris), **5**, 353; Monit. sci. (Quesneville), **7**, 1007; Chem. News, **12**, 171; Ztschr. Chem., **9**, 30; Chem. Centrbl., 1866, 63; Jsb., 1865, 184.

1865 : 86. HERMANN. (Ferrocyanide.)

J. prakt. Chem., **95**, 127; Jsb., 1865, 709.

1865 : 87. HJORTDAHL. (Sodium salts.)

Compt. rend., **61**, 175, 213; Ann. Chem. (Liebig), **137**, 34, 236; Instit., 1865, 251; Chem. News, **12**, 58, 69; J. de Pharm. [4], **3**, 148; Bull. Soc. chim. (Paris), **5**, 213; Monit. sci. (Quesneville), **7**, 805; Ztschr. Chem., 1865, 619; Jsb., 1865, 184–6.

1866 : 88. HERMANN. (Preparation from Zircon.)

J. prakt. Chem., **97**, 330; Ztschr. Chem., 1866, 717; Jsb., 1866, 189.

1866 : 89. HERMANN. (Identity of zirconium and norium.)

J. prakt. Chem., **97**, 321; Bull. Soc. chim. (Paris), **6**, 383–5; Chem. News, **14**, 33; Ztschr. Chem., 1866, 443; Jsb., 1866, 191.

1866 : 90. HERMANN. (Separation from earths.)

J. prakt. Chem., **97**, 337 ; Ztschr. anal. Chem., **5**, 381–4 ; Bull. Soc. chim. (Paris), **6**, 385–7 ; Chem. News, **14**, 33 ; Jsb., 1866, 797–8.

1868 : 91. WEBSKY. (Occurrence in kochelite.)

Jahrb. Miner., 1868, 607 ; Jsb., 1868, 1013.

1868 : 92. FIZEAN. (Expansion of Zircon by heat.)

Compt. rend., **66**, 1005 ; Ann. der Phys. (Pogg.), **135**, 380 ; Phil. Mag. [4], **36**, 31 ; Jsb., 1868, 52.

1868 : 93. CARON. (Zirconia light.)

Compt. rend., **66**, 850, 1040 ; Ann. chim. phys. [4], **14**, 311–5 ; Monit. sci. (Quesneville), 1868, 496, 899 ; Ztschr. Chem., **11**, 536 ; Chem. News, **17**, 276 ; Wagner's Jsb., **14**, 754, 756 ; Jsb., 1868, 979.

1869 : 94. STREIT and FRANZ. (Separation from titanium.)

J. prakt. Chem., **108**, 75 ; Ztschr. anal. Chem., **9**, 388–90 ; Ztschr. Chem., **13**, 256 ; Chem. Centrbl., 1870, 98, 319 ; Jsb., 1869, 915.

1869 : 95. TESSIÉ DU MOTAY. (Zirconia light.)

Wagner's Jsb., **15**, 730 ; Chem. News, **19**, 107, 213, 310 ; Dingl. Polyt. J., 191, 252.

1869 : 96. DARKER. (Zirconia light.)

Chem. News, **19**, 499 ; Dingl. Polyt. J., **194**, 519 ; Wagner's Jsb., **15**, 730.

1869 : 97. HARRISON. (Zirconia light.)

Mechan. Mag., 1869, 458 ; Polyt. Centr., 1869, 1461 ; Wagner's Jsb., **15**, 731.

1869 : 98. PAYEN. (Zirconia light.)

Genie industriel, 1869, 161 ; Polyt. Centr., 1869, 966 ; Dingl. Polyt. J., **193**, 433 ; Wagner's Jsb., **15**, 752.

1869 : 99. VOGT. (Zirconia light.)

Köln. Zeit., 1869, No. 159 ; Wagner's Jsb., **15**, 750–1.

1869 : 100. ———. (Zirconia light.)

Pharm. J. [2], **11**, 81–2.

1869 : 101. THALÉN. (Spectrum.)

Ann. chim. phys. [4], **18**, 228.

1869 : 102. SORBY. (A new element, jargonium, in Zircon.)

Lond. Roy. Soc. Proc., **17**, 511 ; Ann. der Phys. (Pogg.), **138**, 58–65 ; Chem. News, **19**, 121–3, 142, 181 ; Ber., **2**, 126, 193, 337, 382 ; Bull. Soc. chim. (Paris), **12**, 36 ; Ztschr. Chem., 1869, 221, 403 ; Ann. chim. phys. [4], **18**, 487 ; Am. J. Sci. [2], **48**, 405 ; Wagner's Jsb., **15**, 1 ; Jsb., 1869, 261.

1869 : 103. FORBES. (Jargonia.)

Intellectual Observer, **9**, 291 ; Chem. News, **19**, 277.

1869 : 104. SORBY. (Spectrum of mixtures of Zirconium and uranium.)

Ber., **3**, 146; Bull. Soc. chim. (Paris), **14**, 40 ; Chem. Centrbl., 1870, 369 ; Lond. Roy. Soc. Proc., **18**, 197 ; Phil. Mag. [4], **39**, 65.

1869 : 105. CHURCH. (Idem.)

Chem. News, **20**, 9.

1870 : 106. MELLISS. (Metal. Salts.)

Bull. Soc. chim. (Paris), **14**, 204 ; Ber., **4**, 57 ; Chem. News, **22**, 23 ; Ann. Chem. (Liebig), **153**, 238 ; Ztschr. Chem., 1870, 296 ; Jsb., 1870, 328 ; Chem. Centrbl., 1870, 392.

1870 : 107. HUGGINS. (Spectrum.)

Lond. Roy. Soc. Proc., **18**, 548.

1870 : 108. FRANZ. (Metal. Preparation of pure salts.)

Ber., **3**, 58–60 ; Bull. Soc. chim. (Paris), **13**, 507 ; Ztschr. Chem., 1870, 468 ; Chem. Centrbl., 1870, 131 ; Wagner's Jsb., **16**, 1, 2 ; Jsb., 1870, 329.

1870 : 109. WUNDER. (Isomorphism with titanic and stannic oxides.)

J. prakt. Chem. [2], **2**, 206–12 ; Chem. News, **22**, 215 ; Ztschr. Chem., 1870, 286 ; Jsb. Min., 1870, 1000 ; Gazz. chim. ital., **1**, 527 ; Chem. Centrbl., 1870, 663.

1871 : 110. MENDELÉJEFF. (Fluoride.)

Ber., **4**, 933.

1871 : 111. RATH. (Occurrence in diorite.)

Ann. der Phys. (Pogg.), **144**, 250.

1871 : 112. KNOP. (Artificial production of crystals.)

Ann. Chem. (Liebig), **157**, 363 ; **159**, 36 ; Bull. Soc. chim. (Paris), **15**, 190 ; Ztschr. Chem., 1871, 397 ; J. Chem. Soc. (Lond.), **24**, 805 ; Jsb., 1871, 322.

1871 : 113. TROOST and HAUTEFEUILLE. (Oxychloride.)

J. prakt. Chem. [2], **4**, 298 ; Compt. rend., **73**, 563 ; Instit., 1871, 49 ; Bull. Soc. chim. (Paris), **16**, 240 ; J. Chem. Soc. (Lond.), **24**, 1000 ; Gazz. chim. ital., **1**, 628 ; Jsb., 1871, 293.

1871 : 114. TROOST and HAUTEFEUILLE. (Spectrum.)

Compt. rend., **73**, 620 ; Instit., 1871, 77 ; Arch. ph. nat., **42**, 178 ; Bull. Soc. chim. (Paris), **16**, 229 ; Ztschr. Chem., 1871, 465 ; J. Chem. Soc. (Lond.), **24**, 1147 ; Jsb., 1871, 169.

1871 : 115. RAMMELSBERG. (Separation from niobic and tantalic acids.)

J. Chem. Soc. (Lond.), **25**, 195 ; Ber., **4**, 875.

1872 : 116. RAMMELSBERG. (Action of heat on amorphous oxide.)
Ber., **5**, 1006.

1872 : 117. RAMMELSBERG. (Sulphate.)
Ber., **5**, 1005.

1872 : 118. TROOST and HAUTEFEUILLE. (Action of silicon chloride on oxide.)
Compt. rend., **75**, 1819 ; Ber., **6**, 34 ; Gazz. chim. ital., **2**, 27 ; Jsb., 1872, 226.

1872 : 119. NORDENSKJÖLD. (Occurrence in nohlite.)
Bull. Soc. chim. (Paris), **18**, 178.

1873 : 120. MALLARD. (Behavior of oxide with sodium carbonate.)
Compt. rend., **75**, 472 ; Gazz. chim. ital., **3**, 84.

1873 : 121. HANNAY. (Zirconia.)
J. Chem. Soc. (Lond.), **26**, 703–10 ; Chem. News, **27**, 232 ; Ber., **6**, 571 ; Am. Chemist, **4**, 194 ; Jsb. rein. Chem., **1**, 73 ; Gazz. chim. ital., **3**, 468.

1873 : 122. MIXTER and DANA. (Specific heat.)
Ann. Chem. (Liebig), **169**, 388 ; Chem. Centrbl., 1873, 721 ; Bull. Soc. chim. (Paris), **21**, 68 ; Jsb. rein. Chem., **1**, 73 ; J. Chem. Soc. (Lond.), **27**, 118 ; Am. J. Sci. [3], **7**, 506–7 ; Gazz. chim. ital., **3**, 577 ; **5**, 107 ; Jsb., 1873, 58.

1873 : 123. PAYKULL. (Compounds : Hydroxide, oxychloride, double chlorides, sulphate, arsenate, and ortho-phosphate.)
Oefvers. Sv. Vetensk. Akad. Förh., 1873, 22 ; Ber., 1873, 1467 ; Jsb. rein. Chem., **1**, 73 ; Bull. Soc. chim. (Paris), **20**, 65 ; Chem. News, **28**, 45 ; J. Chem. Soc. (Lond.), **26**, 1105 ; Chem. Centrbl., 1873, 594 ; Gazz. chim. ital., **3**, 484 ; Am. Chemist, **4**, 393 ; Jsb., 1873, 263.

1873 : 124. JANNETTAZ. (Propagation of heat by Zirconia.)
Ann. chim. phys. [4], **29**, 33.

1874 : 125. TROOST and HAUTEFEUILLE. (Spectrum.)
Compt. rend., **73**, 620 ; Ztschr. anal. Chem., **13**, 313–4.

1875 : 126. ENDEMANN. (Soluble basic salts.)
Am. Chemist, **5**, 326–7 ; Bull. Soc. chim. (Paris), **24**, 466 ; J. prakt. Chem. [2], **11**, 219 ; Jsb. rein. Chem., **3**, 84 ; J. Chem. Soc. (Lond.), **28**, 1162 ; Gazz. chim. ital., **6**, 428 ; Chem. Centrbl., 1875, 339 ; Jsb., 1875, 219.

1875 : 127. NILSON. (Selenites.)
"Researches on Salts of Selenious Acid," Upsala, 1875.

1876 : 128. NILSON. (Platinate.)
Ber., **9**, 1143 ; Bull. Soc. chim., **27**, 209 ; Jsb., 1876, 294.

1876 : 129. HORNBERGER. (Comparison with silicon. Preparation pure chloride. Alkaline tartrates. Cyanogen compounds.)

Am. Chem. (Liebig), **181**, 232 ; Bull. Soc. chim. (Paris), **26**, 493 ; Jsb. rein. Chem., **4**, 90 ; J. de Pharm. [4], **25**, 154 ; J. Chem. Soc. (Lond.), **30**, 275 ; Chem. News, **33**, 261 ; Gazz. chim. ital., **7**, 166, 232 ; Chem. Centrbl., 1876, 435 ; Jsb., 1876, 240.

1877 : 130. PHILIPP. (Technology.)

Jsb., 1877, 1121.

1877 : 131. DRAPER. (Zirconia cylinders for oxyhydrogen light.)

Am. J. Sci. [3], **14**, 208 ; Chem. Centrbl., 1877, 673.

1877 : 132. VINCENT. (Behavior towards trimethylaniline.)

Bull. Soc. chim. (Paris), **27**, 194 ; Chem. Centrbl., 1878, 263.

1878 : 133. PHILIPP. (Zirconia light.)

Monit. sci. (Quesneville), **20**, 481.

1878 : 134. MALLET. (Occurrence in sipylite.)

Am. J. Sci. [3], **14**, 397 ; Chem. Centrbl., 1878, 7.

1879 : 135. FRIEDEL and CRAFTS. (Action of chloride on organic compounds.)

Bull. Soc. chim. (Paris), **31**, 531 ; Ber., **12**, 373.

1879 : 136. PAYKULL. (Compounds.)

Ber. **12**, 1719.

1880 : 137. ÄNGSTRÖM. (Oxide, diamagnetic.)

Jsb., 1880, 338 ; Dammer II., 1, 619.

1880 : 138. SORET. (Spectrum.)

Arch. ph. nat. [3], **4**, 261 ; Jsb., 1880, 214.

1880 : 139. NILSON and PETTERSSON. (Specific heat.)

Compt. rend., **91**, 232 ; Ber., **13**, 1461 ; Jsb., 1880, 237.

1880 : 140. VINCENT. (Behavior towards dimethylaniline.)

Bull. Soc. chim., Paris, **33**, 156–8 ; Ztschr. anal. Chem., **19**, 479 ; Chem. Centrbl., 1880, 279.

1881 : 141. CLARKE. (Atomic weight.)

Phil. Mag. [5], **12**, 101 ; Am. Chem. J., **3**, 263 ; Jsb., 1881, 7.

1881 : 142. CROOKES. (Phosphorescent spectrum.)

Bakerian Lecture, May 31, 1883, Lond. Roy. Soc. Proc., **32**, 206 ; Ann. chim. phys. [5], **23**, 555 ; Compt. rend., **92**, 1281 : Chem. News, **43**, 237 ; Jsb., 1881, 131.

1882 : 143. WELLER. (Action of hydrogen peroxide on.)

Ber., **14**, 2592 ; Jsb., 1882, 1292.

1882 : 144. CLASSEN. (Electrolytic separation.)

Ber., **14**, 2783 ; Zeit. anal. Chem., **22**, 421 ; Chem. Centrbl., 1882, 233.

1882 : 145. LEVY and BOURGEOIS. (Microchemical reaction.)

Compt. rend., **94**, 812 ; Chem. News, **45**, 240 ; Jsb., 1882, 1527.

1882 : 146. BOISBAUDRAN. (Separation from gallium.)

Compt. rend., **94**, 1154 ; Chem. News, **45**, 207 ; Jsb., 1882, 1296.

1883 : 147. DONATH and MAYRHOFER. (Affinity.)

Ber., **16**, 1588 ; Jsb., 1883, 26.

1884 : 148. CLARKE. (Atomic weight.)

Chem. Ztg., **8**, 930.

1884 : 149. STOLBA. (Opening up Zircons.)

Chem. News, **49**, 174 ; J. Chem. Soc., **46**, 821 ; Jsb., 1884, 1594.

1885 : 150. GROSHAUS. (Density.)

Rev. Trav. chim. pays bas., **4**, 236 ; Jsb., 1885, 53.

1885 : 151. CROOKES. (Spectrum when samarium is present.)

Compt. rend., **100**, 1380 ; Lond. Roy. Soc. Proc., **38**, 414 ; Chem. News, **51**, 301 ; Jsb., 1885, 332.

1885 : 152. DEMARÇAY. (Separation from titanium.)

Compt. rend., **100**, 740-742 ; Rep. anal. Chem., 1885, 186 ; Chem. Centrbl., **56**, 283 ; Jsb., 1885, 1929.

1885 : 153. CLÉVE. (Peroxide.)

Bull. Soc. chim. (Paris), **43**, 57 ; Ztschr. anal. Chem., **28**, 699 ; Jsb., 1885, 492.

1885 : 154. LINNEMANN. (Qualitative composition. Opening up Zircons.)

Monatsh. Chem., **6**, 335–47 ; Chem. Ztg., **9**, 1244 ; Ber., **18**, c, 459, 460 ; J. Chem. Soc., **48**, 1042 ; Chem. News, **52**, 233, 240 ; Chem. Centrbl., **56**, 666, 667.

1885 : 155. LINNEMANN. (Absorption spectra of Zircons.)

Monatsh. Chem., **6**, 531, 536 ; Ber., **18**, c, 605 ; J. Chem. Soc., **48**, 1173 ; Chem. News, **52**, 220 ; Chem. Centrbl., **56**, 907 ; Jsb., 1885, 2271.

1886 : 156. BAILEY. (Separation and estimation by hydrogen peroxide.)

J. Chem. Soc., **49**, 149-152 ; Chem. News, **53**, 55, 260 ; Ann. Chem. (Liebig), **232**, 352 ; Ber., **19**, c, 319 ; Chem. Ztg., **10**, 1, 148, 677 ; Pharm. J. [3], **16**, 1022 ; Chem. Centrbl., **57**, 172, 451.

1886 : 157. BAILEY. (Separation and estimation by hydrogen peroxide.)

J. Chem. Soc. (Lond.), **49**, 481–6 ; Chem. News, **53**, 160 ; Am. J. Sci., **26**, 470 ; Ztschr. anal. Chem., **28**, 699 ; Ann. Chem. (Liebig), **232**, 352 ; Ber., **19**, c, 881 ; Chem. Centrbl., **57**, 682 ; Jsb., 1886, 1942.

1886 : 158. LINNEMANN. (Zirconia light.)

Monatsh. Chem., **6**, 899–908 ; J. Chem. Soc. (Lond.), **50**, 417 ; Chem. Centrbl., **57**, 263, 264 ; Wagner's Jsb., **32**, 381–4 ; Jsb., 1885, 2167.

1886 : 159. HAUTEFEUILLE and MARGOTTET. (Phosphate.)

Compt. rend., **102**, 1017–1019 ; Ber., **19**, c, 387 ; J. Chem. Soc. (Lond.), **50**, 670 ; Chem. News, **53**, 252 ; Chem. Centrbl., **57**, 468 ; Jsb., 1886, 447.

1886 : 160. VAN DER PLAATS. (Atomic weight.)

Ann. chim. phys. [6], **7**, 501 ; Zeitschr. anal. Chem., **26**, 276.

1886 : 161. TROOST and OUVRARD. (Double potassium phosphate.)

Compt. rend., **102**, 1422–7 ; Ber., **19**, c, 659 ; J. Chem. Soc., **50**, 853 ; Chem. Centrbl., **57**, 594 ; Jsb., 1886, 453, 454.

1887 : 162. MEYER and WILKINS. (Action of carbon tetrachloride on oxide.)

Ber., **20**, 683 ; Jsb., 1887, 379.

1887 : 163. DITTE. (Behavior towards sulphuric acid. Selenate.)

Compt. rend., **104**, 172 ; Jsb., 1887 [1], 547, 549 ; Dammer. II, 1, 622.

1887 : 164. RAMMELSBERG. (Separation from thorium, cerium, etc.)

Sitzber. Akad. Wissin., Berlin, 1886, 441 ; Ber., **20**, c, 413.

1887 : 165. PICCINI. (Action of hydrogen peroxide.)

Gazz. chim. ital., **17**, 486 ; Jsb., 1887, 551.

1887 : 166. DEMARÇAY. (Action of carbon tetrachloride on Zirconia.)

Compt. rend., **104**, 113 ; Ber., **20**, c, 96 ; Chem. Centrbl., **58**, 214 ; Jsb., 1887, 380.

1887 : 167. WILLGERODT. (Action as a chloridizing agent.)

J. prakt. Chem. [2], **35**, 391 ; Ber., **20**, c, 312 ; Chem. Centrbl., **58**, 720 ; Jsb., 1887, 618.

1887 : 168. WEIBULL. (Crystalline forms of Zirconyl chloride and bromide ; also sulphate.)

Ber., **20**, a, 1894–6 ; J. Chem. Soc. (Lond.), **52**, 778 ; Chem. Centrbl., **58**, 778 ; Jsb., 1887, 553.

1887 : 169. TROOST and OUVRARD. (Double sodium phosphate. Comparison with thorium.)

Compt. rend., **105**, 30–4 ; Ber., **20**, c, 534 ; J. Chem. Soc. (Lond.), **52**, 1017 ; Chem. News, **56**, 57 ; Chem. Centrbl., **58**, 1015 ; Jsb., 1887, 554–6.

1887 : 170. HINSBERG. (Attempt to prepare Zirconium ethyl. Iodide.)

Ann. Chem. (Liebig), **239**, 253–6 ; Ber., **20**, c, 413 ; J. Chem. Soc. (Lond.), **52**, 896 ; Chem. News, **56**, 219 ; Chem. Centrbl., **58**, 1016 ; Jsb., 1887, 553.

1887 : 171. TROOST and OUVRARD. (Zircon not isomorphous with thorium silicate.)

Compt. rend., **105**, 255 ; Chem. Centrbl., **58**, 1098 ; Jsb., 1887, 556 ; Ber., **20**, c, 534.

1887 : 172. WELSBACH. (Welsbach burners.)

Ber., **20**, c, 406 ; Chem. News, **55**, 192 ; Chem. Centrbl., 1887, 1125 ; Jsb., 1887, 2670 ; German Patent, 39, 162.

1888 : 173. HAUTEFEUILLE and PERREY. (Artificial preparation of Zircon.)

Compt. rend., **107**, 1000, 1001 ; Ber., **22**, c, 94 ; J. Chem. Soc. (Lond.), **56**, 355 ; Chem. News, **59**, 11 ; Monit. sci. (Quesneville), **33**, 199 ; Chem. Centrbl., 1889 [1], 127 ; Jsb., 1888, 638.

1888 : 174. BLÖMSTRAND. (Constitution of silicates containing Zirconium.)

Ztschr. Kryst., **15**, 83, 84 ; Chem. Centrbl., 1889 [1], 821 ; Jsb., 1888, 637.

1888 : 175. KEEPORT. (Application in gold metallurgy.)

Ber., **21**, c, 458 ; Wagner's Jsb., **34**, 369 ; Jsb., 1888, 2650 ; German Patent, 43, 231.

1888 : 176. CARNELLEY and WALKER. (Action of heat on hydrate.)

J. Chem. Soc. (Lond.), **53**, 68, 82 ; Ber., **21**, 131.

1888 : 177. SCHMIDT and HAENSCH. (Emissive power of Linnemann's light.)

Ann. der Phys. (Pogg.), Berbl., **12**, 244 ; Jsb., 1888, 2838.

1889 : 178. RIÖRDÅN. (Preparation from eudialyte.)

Chem. Centrbl., 1889, 533.

1889 : 179. WELSBACH. (Preparation of pure nitrate.)

Chem. Ztg., **13** [2], 1192 ; American Patent, 409, 653.

1889 : 180. STOLBA. (Opening up Zircon.)

Listy chemické, **13**, 117, 118 ; Chem. Centrbl., 1889, 1, 297.

1889 : 181. DAVIS. (Separation from aluminium.)

Amer. Chem. J., 11, 26–9 ; Ztschr. anal. Chem., 29, 454, 455 ; Ber., 22, c, 300 ; J. Chem. Soc. (Lond.), 56, 551 : Chem. News, 59, 100, 101 ; Chem. Centrbl., 60. 1, 454 : Jsb., 1889, 2388.

1889 : 182. DAY. (Production in United States.)

Mineral Resources, U. S. 6th report ; J. Soc. Chem., Ind., 8, 591.

1889 : 183. BAILEY. (Atomic weight. Oxychloride. Peroxide.)

Lond. Roy. Soc. Proc., 46, 74–87 ; Chem. News, 60, 6–8, 17, 18, 32 ; J. Chem. Soc. (Lond.), 58, 705 ; Ztschr. anal. Chem., 29, 743–7 : Nature, 36, 568 ; Ber., 22, c, 655, 666 ; Ztschr. physikal Chem., 4, 494 ; Chem. Centrbl., 1889 [2], 311, 312 : Jsb., 1889, 113–6 ; Brit. Assn. Trans., 1887, 636.

1890 : 184. HAUTEFEUILLE and PERREY. (Action of hydrochloric acid gas on oxide.)

Compt. rend., 110, 1038 ; Ber., 23, c, 428 ; J. Chem. Soc. (Lond.), 58 1071.

1890 : 185. WARREN. (Precipitation by magnesium.)

Chem. News, 61, 183 ; Ber., 23, c, 560 ; Jsb., 1890, 42.

1890 : 186. HIRSCHWALD. (Solubility in microcosmic salt bead.)

J. prakt. Chem. [2], 41, 360 ; Jsb., 1890, 2421.

1890 : 187. WINKLER. (Reduction of oxide by magnesium.)

Ber., 23, b, 2664–8 ; J. Chem. Soc. (Lond.), 58, 1375 : Chem. Centrbl., 1890 [2], 644, 645 ; Jsb., 1890, 432.

1890 : 188. IMRAY. (Preparation from ores.)

J. Soc. Chem. Ind., 9, 941 ; English Patent, 16, 555.

1890 : 189. KOCHS. (Zirconia light.)

Dingl. Polyt. J., 278, 235–40 ; J. Soc. Chem. Ind., 10, 37 ; Wagner's Jsb., 37, 62 ; Eng. and Mining J., 51, 466 ; Jsb., 1890, 2850.

1891 : 190. VENABLE. (Preparation of pure chloride.)

J. anal. Chem., 5, 551 ; J. El. Mitchell Sc. Soc., 8, 20 ; Chem. Ztg., 15, 328 ; J. Chem. Soc. (Lond.), 62, 412 ; Chem. News, 64, 315, 316 ; Chem. Centrbl., 1891 [1], 149 ; Jsb., 1891, 575.

1891 : 191. DROSSBACH. (Zirconia pencils.)

Chem. Ztg., 15 [1], 328 ; Chem. Centrbl., 1891 [1], 772, 773.

1891 : 192. BEHRENS. (Microchemical reaction.)

Ztschr. anal. Chem., 30, 156 ; Chem. News, 64, 124.

1891 : 193. MOREHEAD. (Analysis of Zircon.)

J. El. Mitchell Sc. Soc., 8, 24.

1891 : 194. WINKLER. (Action of magnesium on oxide. Hydride.)

Ber., **24**, a, 888; J. Chem. Soc. (Lond.), **60**, 802; Bull. Soc. chim. (Paris), [3], **6**, 173; Chem. Centrbl., 1891 [1], 912; Jsb., 1891, 499.

1891 : 195. VENABLE. (Occurrence.)

J. El. Mitchell Sc. Soc., **8**, 74.

1891 : 196. OUVRARD. (Alkaline Zirconates.)

Compt. rend., **112**, 1444–6; Ber., **24**, c, 694; J. Chem. Soc. (Lond.), **60**, 1431; Monit. sci. (Quesneville), **37**, 868; Chem. News, **64**, 26; Chem. Centrbl., **62**, 2248; Jsb., 1891, 576.

1891 : 197. OUVRARD. (Alkaline earth Zirconates.)

Compt. rend., **113**, 80–2; Monit. sci. (Quesneville), **37**, 976; J. Chem. Soc. (Lond.), **60**, 1431; Chem. News, **64**, 61; Chem. Centrbl., 1891 [2], 415; R. Meyer's Jahrb., **1**, 89.

1891 : 198. WALLER. (Zirconium light.)

Eng. and Mining J., **51**, 520.

1892 : 199. CHRUSTSCHOFF. (Artificial production Zircon.)

Jahrb. Mineralogie, 1892 [2], 232–6; Chem. Centrbl., 1893 [1], 123; [2], 880, 881.

1893 : 200. BASKERVILLE. (Comparison of methods of analysis.)

Doctorate Dissertation, J. El. Mitchell Sc. Soc., **10**, 45–68.

1893 : 201. McKEAN. (Color of light emitted.)

Zeit. Ver. Deutschr. Ing., 1893, 310; R. Meyer's Jahrb., **3**, 335.

1893 : 202. VENABLE. (Examination of chlorides.)

J. El. Mitchell Sc. Soc., **10**, 79–87.

1893 : 203. MOISSAN. (Volatilization in electric furnace.)

Compt. rend., **116**, 1222–4; J. Chem. Soc. (Lond.), **64** [2], 532; Chem. News, **68**, 16; Ber., **26**, d, 482; Ztschr. anorg. Chem., **4**, 473; Bull. Soc. chim. (Paris), [3], **11**, 863–4; Chem. Centrbl., 1893 [2], 190; R. Meyer's Jahrb., **3**, 71.

1893 : 204. TROOST. (Preparation of metal in electric furnace.)

Compt. rend., **116**, 1227–30; J. Chem. Soc. (Lond.), **64** [2], 473; Bull. Soc. chim. (Paris), [3], **9**, 792; Ber., **26**, d, 483; Ztschr. anorg. Chem., **4**, 474; R. Meyer's Jahrb., **3**, 75; Chem. Centrbl., 1893 [2], 191.

1893 : 205. TROOST. (Preparation of oxide in electric furnace.)

Compt. rend., **116**, 1428, 1429; J. Chem. Soc. (Lond.), **64** [2], 532; Chem. News, **68**, 28; Ztschr. anorg. Chem., **5**, 241; Bull. Soc. chim. (Paris), [3], **9**, 794; Ber., **26**, d, 669; Chem. Centrbl., 1893 [2], 356.

1893 : 206. PÉCHARD. (Molybdate.)

Compt. rend., **117**, 788–90; J. Chem. Soc. (Lond.), **66** [2], 96; Bull. Soc. chim. (Paris), [3], **11**, 184; Ztschr. anorg. Chem., **6**, 200; Ber., **27**, d, 2; Chem. Centrbl., 1893 [1], 140.

1894 : 207. READ. (Behavior of oxide at high temperatures.)

J. Chem. Soc. (Lond.), **65**, 314.

1894 : 208. WITT. (Emissive power in Welsbach burner.)

Wagner's Jsb., **40**, 540.

1894 : 209. BASKERVILLE. (Separation by sulphur dioxide.)

J. Amer. Chem. Soc., **16**, 475, 476; J. Chem. Soc. (Lond.), **66** [2], 401; Chem. News, **70**, 57; Ztschr. anorg. Chem., **7**, 434; Bull. Soc. chim. (Paris), [3], **12**, 1283; Chem. Centrbl., 1894 [2], 299; R. Meyer's Jahrb., **4**, 98; J. El. Mitchell Sc. Soc., **11**, 85–7.

1894 : 210. VENABLE. (Chlorides. Separation from silicon and iron.)

J. Amer. Chem. Soc., **16**, 469–75; Chem. News, **70**, 217–9; J. Chem. Soc. (Lond.), **66** [2], 385; Chem. Centrbl., 1894 [2], 299; R. Meyer's Jahrb., **4**, 98.

1895 : 211. SMITH and HARRIS. (Action of phosphorus pentachloride on oxide.)

J. Amer. Chem. Soc., **17**, 654–6; J. Chem. Soc. (Lond.), **70** [2], 179; Bull. Soc. chim. (Paris), [3], **16**, 225; Chem. Centrbl., 1895 [2], 590.

1895 : 212. VENABLE and BASKERVILLE. (Sulphites.)

J. Amer. Chem. Soc., **17**, 448–53; J. Chem. Soc. (Lond.), **70** [2], 527; J. El. Mitchell Sc. Soc., **12**, 16–22; Bull. Soc. chim. (Paris), [3], **14**, 107; Chem. Centrbl., 1895 [2], 15.

1895 : 213. VENABLE. (Chlorides.)

J. Amer. Chem. Soc., **17**, 842, 843; J. El. Mitchell Sc. Soc., **12**, 22, 23; J. Chem. Soc. (Lond.), **70** [2], 478; Chem. News, **73**, 25; Chem. Centrbl., 1896 [1], 15.

1896 : 214. LARSSON. (Niobate.)

Ztschr. anorg. Chem., **12**, 203; Ber., **29**, d, 635; Chem. Centrbl., 1896 [2], 235; J. Chem. Soc., **70** [2], 564.

1896 : 215. BARNES. (Use as a mordant.)

J. Soc. Chem. Ind., **15**, 420; Ber., **29**, d, 1097.

1896 : 216. PICCINI. (Action of hydrogen peroxide on fluoride.)

Ztschr. anorg. Chem., **10**, 438; Ber., **29**, d, 129.

1896 : 217. LANDOLT. (Zirconia light.)

Ztschr. anal. Chem., **35**, 714.

1896 : 218. PHIPSON. (Abundant source in Norwegian granite.)

Chem. News, **73**, 145 ; Bull. Soc. chim. (Paris), [3], **16**, 1756 ; J. Chem. Soc., **70** [2], 422 ; Chem. Centrbl., 1896 [1], 1052.

1896 : 219. MOISSAN and LENGFELD. (Carbide.)

Compt. rend., **122**, 651–4 ; Bull. Soc. chim. (Paris), [3], **15**, 1275–8 ; Monit. sci. (Quesneville), **46**, 393 ; Ber., **29**, d, 343 ; Chem. Centrbl., 1896 [1], 1887 ; R. Meyer's Jahrb., **6**, 78.

1896 : 220. HALLOPEAN. (Tungstates.)

Bull. Soc. chim. (Paris), [3], **15**, 917–23 ; Compt. rend., **122**, 1419–22 ; Chem. News, **74**, 12 ; Monit. sci. (Quesneville), **47**, 636 ; J. Chem. Soc. (Lond.), **70** [2], 607 ; Ber., **29**, d, 582 ; Chem. Centrbl., 2896 [2], 775.

1896 : 221. VENABLE and T. CLARKE. (Various Zirconates of Alkalies and alkaline earths.)

J. Amer. Chem. Soc., **18**, 434–44 ; J. El. Mitchell Sc. Soc., **13**, 1–13 ; Chem. News, **74**, 42–4, 54, 55 ; J. Chem. Soc. (Lond.), **70** [2], 653 ; Ber., **29**, d, 1094 ; Chem. Centrbl., 1896 [2], 11, 12.

1896 : 222. ST. JOHN. (Illuminating power of oxide.)

Ann. der Phys. (Wied.), **56**, 433 ; Wagner's Jsb., **42**, 72.

1896 : 223. TRAUBE. (Opening up Zircons.)

Jahrb. Mineral., **10**, 470–6 ; Chem. Centrbl., 1896 [2], 130.

1896 : 224. MÜLLER-JACOBS. (Tannate.) ?

American Patent, 558, 197 ; Ber., **29**, d, 448.

1896 : 225. MOISSAN. (Carbide.)

Compt. rend., **122**, 1462 ; Ber., **29**, d, 614 ; Chem. News, **73**, 175 ; J. Chem. Soc. (Lond.), **70** [2], 428 ; R. Meyer's Jahrb., **6**, 78.

1896 : 226. WELLS and FOOTE. (Double fluorides.)

Ztschr. anorg. Chem., **10**, 434–7 ; Ber., **29**, d, 128 ; J. Chem. Soc. (Lond.), **70** [2], 179 ; Chem. Centrbl., 1896 [1], 239 ; R. Meyer's Jahrb., **7**, 86.

1896 : 227. DENNIS and SPENCER. (Tetraiodide.)

J. Amer. Chem. Soc., **18**, 673–9 ; Chem. News, **74**, 102–4 ; Ber., **29**, d, 1097 ; Chem. Centrbl., 1896 [2], 651, 652 ; R. Meyer's Jahrb., **6**, 82.

1896 : 228. FRESENIUS and HINTZ. (Determination in thorium nitrate.)

Ztschr. anal. Chem., **35**, 535.

1896 : 229. GLASER. (Determination in monazite.)

J. Amer. Chem. Soc., **18**, 782–93 ; Chem. News, **75**, 145–7, 157 ; Chem. Ztg., **20**, 612–14 ; Chem. Centrbl., 1896 [2], 803.

1897 : 230. VENABLE and BASKERVILLE. (Oxalates.)

J. Amer. Chem. Soc., **19**, 12–18; J. El. Mitchell Sc. Soc., **14**, 4–12; Chem. News, **75**, 113–15; Chem. Centrbl., 1897 [1], 905; R. Meyer's Jahrb., **7**, 86; J. Chem. Soc. (Lond.), **78**, a [II], 295.

1897 : 231. DELAFONTAINE. (Separation from thorium.)

Chem. News, **75**, 230; Chem. Centrbl., 1897 [2], 70.

1897 : 232. WELLS and FOOTE. (Double fluorides.)

Am. J. Sci. [4], **3**, 466–71; Chem. News, **76**, 44–6; Chem. Centrbl., 1897 [2], 94, 95.

1898 : 233. TRUCHOT. (Occurrence.)

Revue générale des Sciences; Chem. News, **77**, 146.

1898 : 234. VENABLE. (Atomic weight.)

J. Amer. Chem. Soc., **20**, 118–28; Chem. News, **77**, 221–3; J. El. Mitchell Sc. Soc., **14**, 27–46; Chem. Centrbl., 1898 [1], 708, 709; J. Chem. Soc. (Lond.), **78**, a [II], 438.

1898 : 235. VENABLE and BELDEN. (Properties of dioxide.)

J. Amer. Chem. Soc., **20**, 273–6; Chem. Centrbl., 1898 [1], 1095; J. Chem. Soc. (Lond.), **78**, a [II], 597.

1898 : 236. VENABLE and BASKERVILLE. (Oxyhalides.)

J. Amer. Chem. Soc., **20**, 321–9; J. El. Mitchell Sc. Soc., **14**, 12–31; Chem. Centrbl., 1898 [II], 87; J. Chem. Soc. (Lond.), **78**, a [II], 596; Ztschr. angew. chem., 1898, 559 (obs.).

1898 : 237. BOUDONARD. (Determination in monazit.)

Bull. Soc. chim. (Paris), [3], **19**, 10–13; Chem. Centrbl., 1898 [1], 435.

1898 : 238. POSSETTO. (Qualitative analysis.)

Giorn. Farm. Chim., **48**, 49–54; Chem. Centrbl., 1898 [1], 634.

1898 : 239. HABER. (Behavior toward chromates and some organic acids. Formate.)

Monatsh. Chem., **18**, 687–99; Chem. Centrbl., 1898 [1], 657; J. Chem. Soc. (Lond.), **78**, a [II], 295.

1898 : 240. HINTZ. (Influence of dioxide on emissive power of incandescent gas mantels.)

J. Chem. Soc. (Lond.), **78**, a [II], 587.

1898 : 241. DE GRAMONT. (Detection, spectroscopically.)

J. Chem. Soc. (Lond.), **78**, a [II], 636.

1898 : 242. HOLMQUIST. (Niobate.)

J. Chem. Soc. (Lond.), **78**, a [II], 388.

1898 : 243. P. H. WALKER. (Separation from iron and uranium.)

J. Amer. Chem. Soc., **20**, 514; J. Chem. Soc. (Lond.), **78**, a [II], 540.

1898 : 244. MATTHEWS. (Derivatives of the tetrachloride.)
J. Amer. Chem. Soc., **20**, 815.

1898 : 245. MATTHEWS. (Derivatives of the tetrabromide.)
J. Amer. Chem. Soc., **20**, 839.

1898 : 246. MATTHEWS. (Preparation of nitrides.)
J. Amer. Chem. Soc., **20**, 843.

1898 : 247. MATTHEWS. (Separation of iron from Zirconium.)
J. Amer. Chem. Soc., **20**, 846.

1898 : 248. LANDOLT, OSTWALD, and SEUBERT. (Atomic weight.)
Ber., **31** [3], 2762.

AUTHOR INDEX.

Figures refer to the numbers in the second column.

MATTER INDEX.

Figures refer to the numbers in the second column.

SMITHSONIAN MISCELLANEOUS COLLECTIONS.

1258

ON THE CHEAPEST FORM OF LIGHT.

BY

S. P. LANGLEY

AND

F. W. VERY.

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ON THE CHEAPEST FORM OF LIGHT.

FROM STUDIES AT THE ALLEGHENY OBSERVATORY.*

BY

S. P. LANGLEY AND F. W. VERY.

The object of this memoir is to show by the study of the radiation of the fire-fly that it is possible to produce light without heat other than that in the light itself; that this is actually effected now by nature's processes, and that these are cheaper than our industrial ones in a degree hitherto unrealized. By "cheapest" is here meant the most economical in energy, which for our purpose is nearly synonymous with heat; but as a given amount of heat is producible by a known expenditure of fuel at a known cost, the word "cheapest" may also here be taken with little error in its ordinary economic application.

We recall that in all industrial methods of producing light there is involved an enormous waste, greatest in sources of low temperature, like the candle, lamp, or even gas illumination, where, as I have already shown, it ordinarily exceeds 99 parts in the 100; and least in sources of high temperature, like the incandescent light and electric arc, where yet it is still immense and amounts even under the most favorable conditions to very much the larger part.

It has elsewhere † been stated that for a given expense at least one hundred times the light should in theory be obtainable which we actually get by the present most widely used methods of illumination. This, it will be observed, is given as a minimum value, and it is the object of the present research to demonstrate that not only this possible increase, but one still greater, is actually obtained now in certain natural processes, which we know of nothing to prevent our successfully imitating.

It is now universally admitted that wherever there is light there has been expenditure of heat in the production of radiation existing in and as the luminosity itself, since both are but forms of the same energy; but this visible radiant heat which is inevitably necessary is not to be

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* Reprinted, with additional note, from the American Journal of Science, third series, vol. xl, No. 236, August, 1890.

† See results of an investigation by S. P. Langley, read before the National Academy in 1883, and given in "Science" for June 1, 1883, where it is shown that in the ordinary Argand burner gas flame indefinitely *over* 99 per cent of the radiant energy is (for illumination purposes) waste.

considered as waste. The waste comes from the present necessity of expending a great deal of heat in invisible forms before reaching even the slightest visible result, while each increase of the light represents not only the small amount of heat directly concerned in the making of the light itself, but a new indirect expenditure in the production of invisible calorific rays. Our eyes recognize heat mainly as it is conveyed in certain rapid ethereal vibrations associated with high temperatures, while we have no usual way of reaching these high temperatures without passing through the intermediate low ones, so that if the vocal production of a short atmospheric vibration were subject to analogous conditions, a high note could never be produced until we had passed through the whole gamut, from dicontinuous sounds below the lowest bass up successively through every lower note of the scale till the desired alto was attained.

There are certain phenomena, long investigated, yet little understood, and grouped under the general name of "phosphorescent" which form an apparent exception to this rule, especially where nature employs them in the living organism, for it seems very difficult to believe that the light of a fire-fly, for instance, is accompanied by a temperature of 2,000°, or more, Fahr., which is what we should have to produce to gain it by our usual processes. That it is, however, not necessarily impossible, we may infer from the fact that we can by a known physical process produce a still more brilliant light without sensible heat, where we are yet sure that the temperature exceeds this. No sensible heat accompanies the fire-fly's light, any more than need accompany that of the Geissler tube, but this might be the case in either instance, even though heat were there, owing to its minute quantity, which seems to defy direct investigation. It is usually *assumed*, with apparent reason, that the insect's light is produced without the invisible heat that accompanies our ordinary processes, and this view is strengthened by study of the fire-fly's spectrum, which has been frequently observed to diminish more rapidly toward the red than that of ordinary flames.

Nevertheless, this, though a highly probable and reasonable assumption, remains assumption rather than proof, until we can measure with a sufficiently delicate apparatus the heat which accompanies the light and learn not only its quantity, but, what is more important, its quality. Apart from the scientific interest of such a demonstration is its economic value, which may be inferred from what has already been said. I have therefore thought it desirable to make the light of the fire-fly the subject of a new research, in which it is endeavored to make the bolometer supplement the very incomplete evidence obtainable from the visible spec-

may learn from elementary treatises, phenomena of phosphor-
are common to insects, fishes, mollusks, vegetables, and organic
eral matter. Among luminous insects the fire-fly of our fields

is a familiar example, though other of the species attain greater size, and perhaps greater intrinsic brilliancy, especially the *Pyrophorus noctilucus* Linn., found in Cuba and elsewhere. Its length is about 37^{mm}, width 11^{mm}, and it has, like Pyrophori, three light reservoirs—two in the thorax and one in the abdomen. To procure this Cuban fire-fly I invoked the aid of the Smithsonian Institution, and through the kindness of Professor Felipe Poey, of Havana, and Señor Albert Bonzon, of Santiago de Cuba in the Island of Cuba, living specimens of the *Pyrophorus noctilucus* were received here during the summer of 1889. I have also to acknowledge my obligations to Professor C. V. Riley and to Professor L. A. Howard, to whose knowledge and kind care I am doubly indebted.

After a preliminary spectral examination in Washington, I found it more convenient to continue the research at the Allegheny Observatory by means of the very special apparatus supplied by the liberality of the late William Thaw, of Pittsburgh, for researches in the lunar heat-spectrum.* Photometric measurements throughout the spectrum of the insect's light were also made.

I have indicated the steps of the investigation, but the experiments have been so largely and so intelligently made by Mr. F. W. Very that it is just to consider him as an associate rather than an assistant in the researches. I shall accordingly in what follows not discriminate between what each has contributed.

Historical Notes.

We make no attempt to give any bibliography of the subject, and these notes are confined to what seems important in the history of the physical side of it.

Nathaniel Hulme.†—Exper. 6. A dead shining glow-worm was put upon water, contained in a wide-mounted phial, at the temperature of 58. The phial was then sunk in boiling hot water, and as the heat communicated itself to the contents of the phial, the light of the glow-worm became much more vivid.

Exper. 7. Another lucid dead glow-worm was put into warm water, at 114, to see if that degree of heat would extinguish the light, but, on the contrary, its glowing property was augmented. All the water was then poured off, yet the insect continued to shine for some length of time.

Exper. 8. Two living glow-worms were put into a one-ounce phial, with a glass stopple, and though they were perfectly dark at the time, yet if the phial was briskly rubbed with a silken or linen handkerchief till it became pretty warm, it seldom failed to make them display their

* Described in the Memoirs of the National Academy, vol. iv, part ii, p. 112.

† Philos. Trans. Roy. Soc., London, vol. xc, pp. 180, 181, 1800.

light very finely. This experiment was very frequently repeated. It had the same illuminating effect upon the light of a dead glow-worm.

Exper. 9. The complete influence of 212 degrees of heat was now applied to the light of a glow-worm, by pouring upon one when dead, but in a luminous state, some boiling water. Its light was instantly extinguished thereby and did not revive. The experiment was repeated and with the same result.

Macaire * (quoted by Becquerel) found that the luminous matter taken from the body of a glow-worm and heated, increased in brilliancy up to a temperature of about 41° C., after which the light diminished, became reddish, and ceased at 52° C. An electric current increased the luminosity in both the living insect and in the luminous part separated from the remainder of the body, but ceased to have any effect in a vacuum. Oxygen and carbon monoxide increased the light of the living insect and of the luminous matter taken from its body, but the light ceased in a vacuum, in hydrogen, in carbon dioxide, in sulphurous anhydride, and in sulphureted hydrogen.

Carus † observed that the luminous matter taken from the body of the glow-worm ceases to shine when dried, but glows again when moistened.

Matteucci ‡ found that the phosphorescent substance of the Italian glow-worm (*Lampyris Italica*) soon ceased to glow in hydrogen or in carbon dioxide, but shone decidedly brighter in oxygen than in air, the oxygen being consumed and carbon dioxide appearing. He drew the conclusion that the production of light in this insect is entirely due to the combination of oxygen with carbon, which is one of the elements of the phosphorescent matter. The greatest brilliancy occurred at a temperature of 37° or 38° Cent., but all phosphorescence ceased above 50° or below — 6° Cent.

Robert § found that a glow-worm cut in halves continued to glow for half an hour, when the light ceased, but commenced again on the near approach of a candle, and continued as bright as ever for thirty-six hours, after which it was impossible to renew it.

Pasteur || has examined the spectra of our Pyrophorus without finding any appearance of bright or dark lines. He states that M. Gernez has made a similar observation on the spectrum of the glow-worm.

Becquerel ¶ gives a good summary of the results of previous observers. Since phosphorescent solids give banded spectra and thus differ from ignited solids and liquids which have continuous spectra, M. Becquerel

* "Bibliotheque Univ. de Genève," 1821.

† "Analecten zer Natur- und Heilkunde," Leipzig, 1829; see also Comtes Rendus, lix, p. 607, 1864.

‡ "Ann. de chim. et de phys.," III, ix, p. 71, 1843; also in C. R., xvii, p. 309.

§ C. R., xvii, p. 627, 1843.

|| C. R., lix, p. 509, 1864.

¶ "La lumiere," 1867.

concludes, from the apparent continuity of the spectrum of the light from phosphorescent animals, that their light approaches nearer to that of ordinary incandescence—a deduction which the following result renders unnecessary.

C. A. Young * states that the "common" fire-fly gives a continuous spectrum, extending from a little above Fraunhofer's line C in the scarlet, to about F in the blue, gradually fading out at the extremities. He observes that it is noticeable that precisely this portion of the spectrum is composed of rays, which, while they more powerfully than any others affect the organs of vision, produce hardly any thermal or actinic effect. In other words, very little of the energy expended in the flash of the fire-fly is wasted.

(This is a most important and interesting inference, but it will be observed that this is necessarily rather assumed as highly probable than actually demonstrated, since the method did not permit the dealing with the invisible rays except by inference.)

It is quite different with our artificial methods of illumination. In the case of an ordinary gas light, experiments show that at most, one per cent of the radiant energy consists of *visible* rays, the rest being invisible heat; that is to say, over ninety-nine per cent of the gas is wasted in producing rays that do not help in making objects visible. †

Secchi ‡ at first thought that the spectrum of the glow-worm was monochromatic, but with an improved spectroscope, recognized that other colors were present, though feebly, and decided that the spectrum was sensibly continuous.

Quatrefages,§ in connection with the paper of Secchi, remarks that the previous observations of Spallanzani and Macaire, repeated with much care by Matteucci and Becquerel, show beyond doubt that the light of glow-worms and elaters is due to slow combustion. Thus the light is extinguished in a vacuum, and in irrespirable gases, it reappears in contact with the air, it is perceptibly increased by the presence of pure oxygen, it persists after the death of the creature, and finally it is accompanied by the generation of carbon dioxide. Nevertheless, he points out that there is a distinct kind of phosphorescence in the marine Noctilucidæ, due to the contraction of muscular fiber, the shining tissue being seen through the translucent body wall. This species of phosphorescence is increased by irritants, but is independent of the presence of oxygen and is not extinguished or in any way modified by hydrogen or by carbon dioxide.

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* The American Naturalist, Salem, 1870, vol. iii, p. 615.

† S. P. Langley has shown that the waste is in fact even greater than this; see "Science," vol. i, No. 17, p. 482, 1883.

‡ C. R., lxxv, p. 321, 1872.

§ C. R., lxxv, p. 322, 1872.

Robin and *Laboulbene** find the luminous organs of *P. noctilucus* composed of irregularly polyhedral cells, $0{\cdot}04^{mm}$ to $0{\cdot}06^{mm}$ thick, between which pass very numerous fine tracheæ and nerves. The inner face of the organ is composed of adipose tissue, and the outer of a transparent modification of the ordinary chitinous covering of the insect. The authors conclude that the light is due to chemical decomposition of a nitrogenous body with formation of crystalline urates.

Jousset de Bellesme † finds that although the phosphorescent cells, when separated from the body of the insect, continue to glow for several hours, yet if crushed they instantly lose their illuminating power, which indicates that for the production of the light the living cells must retain their integrity, and that they are not mere reservoirs of a phosphorescent substance, but continuous generators of it. He surmises that the light-giving substance may be phosphureted hydrogen.

Meldola ‡ is quoted by Spiller § as having examined the glow-worm spectrum and determined its approximate limits.

Conroy || finds the glow-worm's light green, and in a small direct vision spectroscope showing a continuous spectrum from C to *b*, appearing like a broad band of green light extending from $0^{\mu}{\cdot}518$ to $0^{\mu}{\cdot}587$ with a faint continuous spectrum into the red to $0^{\mu}{\cdot}656$.

R. Du Bois.¶—Perhaps the most important of previous memoirs on phosphorescent insects is by this writer. It contains an account of photometric measures in wave-length scale, and also of heat measures with the thermopile. The latter represent the only attempt even, in this direction, I know of, and seem to be judiciously made but to be insufficient (on account of the limitations of such apparatus) to establish the author's conclusion that the light is accompanied by no sensible heat. This conclusion, we repeat, though very probably correct, does not seem to rest on the évidence of an apparatus of at all the necessary sensitiveness. This memoir, however, appears to be in general an excellent one, and well worthy the student's attention.

From all these statements it is abundantly clear that not only physicists and chemists, but naturalists, have been led to conclude that this light is not associated indissolubly with any so-called vital principle or vital process, but it is a result of certain chemical combinations, and that nothing forbids us to suppose it may be one day produced by some process of the laboratory or manufactory. With this conclusion in mind, we now proceed to observations meant to demonstrate the fact that this

* C. R., lxxvii, p. 511, 1873.

† C. R., xc, p. 318, 1880.

‡ "Proc. Entomological Soc.," p. iii, 1880.

§ "Nature," vol. xxvi, p. 343.

|| "Nature," vol. xxvi, p. 319, 1882.

¶ "Bulletin de la Société Zoologique de France," parts 1, 2, and 3, 1886.

process (presumably discoverable but still unknown) gives light without invisible heat.

These observations are: 1. Photometric. 2. Thermal.

Part 1.—Photometric Observations.

The first impression on viewing the light of the *Pyrophorus noctilucus* through a spectroscope is that it consists essentially of a broad band in the green and yellow, while with precaution we see this extending into and beyond the borders of the blue and orange, but not very greatly farther, and these have been taken by previous observers as its absolute limits. No one appears to have experimentally and distinctly answered the question, "Would the light not extend farther were it bright enough to be seen?" nor has it been proven as clearly as might be desired that the result depends on the quality rather than the quantity of the light, or given conclusive evidence, that if the light of the insect were as bright as that of the sun it would not extend equally far on either side of the spectrum.

It is impossible to increase the intrinsic brilliancy by any optical device, but if it be impossible to make the light of the insect as bright as that of the sun, it is on the other hand quite possible to make the light of the sun no brighter than that of the insect, and this would appear to be the first step in obtaining a definite proof that the apparently narrow limits of the insect's spectrum are due to the intrinsic quality of the light and not to its feeble intensity. The only conclusive method of determining this would appear to be to balance the light from the insect with that of a definite portion of sunlight by any ordinary photometric device; and having taken this sunlight as nearly equal as possible to that of the insect, though certainly not greater, to let this determined quantity fall on the slit of a spectroscope at the same time with the light from the insect, two spectra being formed one over the other in the same field and at the same time.

The actual doing this is not so easy as it might appear, owing to experimental difficulties connected with the insect, a part of which arises from the fact that its light is not only fitful but unequal, being of very varying intensities when not wholly intermittent.

The simplest way in which the experiment can be performed is perhaps the following:

The insect is placed immediately in front of the slit of a spectroscope, so that the light of its thoracic or abdominal portion falls upon the slit. This forms a narrow spectrum which should be brought into the lower or upper half of the field, the insect being attached to the spectroscopic apparatus in a position as nearly fixed as possible. The spectroscope is now placed with the axis of its collimator in the line of a ray of sunlight cast from a heliostat without. In the path of this ray is a screen

with a circular diaphragm covered with ground glass; a lens in front of the slit casts on one portion of it an image of the white circle formed by the ground glass, which image is the same size as the illuminating organ of the insect and forms a spectrum of the same height in the reserved portion of the field. A suitable disposition of lenses placed between the glass screen and the siderostat enables any degree of illumination to be given to the former, from full sunlight to nearly absolute darkness. If the normal spectrum be studied, a grating is selected of such open ruling that the entire visible spectrum of the first order can be seen in the field, but the grating is first so placed that what is seen is not the spectra but the reflected image of the slit, the grating thus acting (at first) the part of a mirror; so that the observer first sees the two circles of light of approximately equal size and brilliancy, one formed by the insect, the other by the sunlight, and the light of this latter, by the arrangement of lenses between the screen and the siderostat is then adjusted so that while remaining of the size of the insect, it is judged to have the same intrinsic brilliancy, or, at any rate, not a superior one.

The essential thing is that a photometric comparison shall be made of the two lights before the spectra are formed, and that under these conditions the sunlight is equal but not superior to that of the insect.

The necessary condition of equality of the two lights from which the spectra are to be formed, having thus been secured, the grating is moved until the two spectra are brought into the field. The result of this direct test is that the solar spectrum when intrinsically of the same brightness, or even when clearly of less brightness than that of the insect, extends somewhat further toward the red and distinctly further toward the violet, the insect light being more intense than that of the sun for equal lights in the green, but ending more abruptly on the violet side.

It may be added that when the insect's light grew brighter the increment appeared to be more in the blue end or as if the average wave-length diminished with the intensity, but there was not opportunity to put this beyond doubt.

Photometric observations in the prismatic spectrum were made previously to the adoption of the arrangement above detailed, the first being on July 1, 1889, using thoracic light. The insect was mounted on an adjustable stand, to which it was attached loosely, so as to give it such freedom of motion as is needed to insure its emitting the light. It was consequently necessary to readjust its position incessantly, and this necessity constitutes a very obvious difficulty. The thoracic light spots are two ovals, each about 2^{mm} by $1{\cdot}5^{mm}$ (see plate I, Fig. 1). Their light is not so bright as the abdominal light, but much steadier, and like that, of a decidedly greenish hue. One of these oval spots was placed over the center of a slit, open just enough to receive the light, or about $1{\cdot}5^{mm}$. This slit was in the focus of a glass lens of 8^{cm} aperture

and 82^{cm} focus, which acted as a collimator. The prism was a very large one of flint (faces $11{\cdot}5^{cm}$ high, $10{\cdot}5^{cm}$ wide), whose mounting included an automatic minimum deviation attachment. The observing lens was similar to the collimator, with a low-power eye-piece in whose field was a pair of heavy vertical parallel wires. The whole was mounted on the spectrometer, primarily designed for bolometric measures and fully described elsewhere.* The insect turned so as to show the abdominal light is depicted in plate I, Fig. 2.

The observer waited for some time in a wholly darkened room, and to the eye thus rendered sensitive, the visible spectrum, before magnification, was about 2^{mm} high and 20^{mm} long, the parallel wires being distinctly visible in the indigo at a setting of 45° 25′, corresponding to a wave-length of $0^{\mu}{\cdot}468$, and in the red at 43° 53′, corresponding to $0^{\mu}{\cdot}640$. The spectrum then was visible from a little beyond F to near C, or through a range of $0^{\mu}{\cdot}172$. As might have been anticipated from the greenish color of the light, the maximum brilliancy was in the green near E, or near wave-length $0^{\mu}{\cdot}53$.† From this point the light fell away on both sides more rapidly than in the solar spectrum. (See plate II, A, B.)

July 2. A comparison of the spectra of the thoracic and of the abdominal light gave the latter upon the average about double the intrinsic brightness of the former. This was only a crude estimate, but more exact methods under the limited time for experiment would have been useless, owing to the very fluctuating character of the light. In continuation of the photometric measurements of the preceding day on the thoracic light, this was compared with that from the flame of an ordinary Bunsen burner at its greatest luminosity, whose area was limited by a diaphragm to that of the size of the thoracic light. The light from the base of this luminous flame (height of flame about $3{\cdot}5^{cm}$, air shut off at base of burner) gave a continuous spectrum, which in these first comparisons was alternated with that of the insect. The spectra were judged to be equal in the blue and the red, but that of the insect was much brighter in the green. Again, a spectrum being formed from light taken midway between the base and point of the flame was found to be everywhere too bright, but especially so in the red.

July 3. Continuation of photometric measures, but with abdominal light. (The abdominal luminous organ is shown in plate I, Fig. 2.)

					μ	
Wires seen in	indigo	45°	29′		0·463	Abdominal light.
"	"	red	43	47	0·663	Range $0^{\mu}{\cdot}200$.
"	"	indigo	46	56	0·390	Range $0^{\mu}{\cdot}382$.
"	"	red	43	21	0·772	Bunsen burner.

(Luminous flame 4^{cm} high, at point one-third down from top, just within inner and slightly darker cone, seen through hole $2{\cdot}5^{mm}$ in diameter.)

*American Journal of Science, March, 1883, p. 188.

† In the normal spectrum the maximum has a wave-length $0^{\mu}{\cdot}57$.

SMITHSONIAN MISCELLANEOUS COLLECTIONS.

1258

ON THE CHEAPEST FORM OF LIGHT.

BY

S. P. LANGLEY

AND

F. W. VERY.

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Glass being interposed, the heat due to this flame radiation fell to 14·5 divisions, or about 8 per cent of the original radiation, showing that of the quality of Bunsen flame heat immediately in question (that above 3^{μ} transmissible by glass) there was still something like 60 times that of the combined body and luminous radiation of the insect in the far less luminous flame. Subsequently, by the use of a lens giving greater concentration, measurable indications of insect radiation above 3^{μ}, and therefore distinct from any possible body heat, were obtained through glass, showing the flame radiation of this quality from an equal area of the same intrinsic brilliancy—*i. e.*, *invisible* heat and of long wave-length, but shorter than 3^{μ}—to be about 400 times that of the insect.

These experiments were repeated with different luminous flames and with different insects on succeeding days. In some of them especially luminous insect specimens were secured, which, with favorable conditions of the galvanometer, gave very measurable deflections on the latter. By a similar use of the glass to that described, it appeared that flames whose intrinsic brilliancy is nearly comparable to that of a point below the middle of the candle flame, and whose total brilliancy is as exactly as possible comparable to that of the insect, give several hundred times the heat of the latter, even if we consider only that quality of heat which is found above 3^{μ}, while if we compare the total radiations (*i. e.*, those directly observed without the use of the glass) the contrast is still stronger.

It follows that the insect light is accompanied by approximately one-four-hundredth part of the heat which is ordinarily associated with the radiation of flames of the luminous quality of those which were the subject of experiment. This value is confirmed by other methods which we do not give here. It will conduce to a clearer comprehension of this if we exhibit in a series of curves derived from our observations the spectral distribution of one unit of energy in the gas-flame spectrum (plate III, Fig. 1); of the electric arc spectrum (plate III, Fig. 2); of the sun (plate V, Fig. 3), and of the insect (plate III, Fig. 4). In all these the abscissæ are the same, the portion between $0^{\mu}\cdot4$ and $0^{\mu}\cdot7$ (violet to red) showing the part of the energy utilized in light, while that from $0^{\mu}\cdot7$ to 3^{μ} shows the part wasted as invisible heat. The energy in each case being the same, the areas are the same, except that owing to the relative importance of the light heat curve (Fig. 4) only about $\frac{1}{20}$ of the latter can be shown in the limits of the plate.

The curves in plate II deal with luminous intensity only, and give no means of drawing those economic conclusions which appear to follow from our experiments and which the curves in plate III supply. These curves (plate III) all exhibit the spectrum on the normal scale, from that easily visible, lying between $0^{\mu}\cdot4$ in the violet and $0^{\mu}\cdot7$ in the red, then to 3^{μ} near the limit of the glass transmission. In the case of the first three, representing spectra of the gas flame, the electric arc, and the sun, nearly all the energy lies above 3^{μ}. In that of the gas flame a consider-

able portion lies below 3^{μ} (and still more in that of the candle flame, if that were shown where most of the energy would lie below 3^{μ} or outside the limits of the drawing). The curves, then, we repeat, represent equal amounts of energy (which without sensible error we may assume to be all exhibited as *heat*) and inclose equal areas.

The total area represents in each case the expenditure of a unit of cost in thermal energy, the area between $0^{\mu}\cdot4$ and $0^{\mu}\cdot7$ the proportion of this utilized as *light*, though, as we have just stated, in the case of Fig. 4, the representative of the fire-fly spectrum, only a fraction of this can be shown (owing to the limits of the drawing).

Resuming, then, what we have said, we repeat that nature produces this cheapest light at about one-four-hundredth part of the cost of the energy which is expended in the candle flame, and at but an insignificant fraction of the cost of the electric light or the most economic light which has yet been devised, and that, finally, there seems to be no reason why we are forbidden to hope that we may yet discover a method (since such a one certainly exists and is in use on the small scale) of obtaining an enormously greater result than we now do from our present ordinary means for producing light.

Appendix.

Determination in Calories of the Heat in the Luminous (Abdominal) Radiation of Pyrophorus noctilucus.

The determination is reached by two steps: (1) The calibration of the galvanometer, so as to give the value of its division in calories, and (2) the inference from the observed deflection in divisions of the total of calories radiated.

1. The bolometer, whose face occupied 0·19 sq. cm. (a), gave a deflection of 342 divisions (b) at a distance of 25 cm. (r) from a 5 cm. circular aperture filled by a blackened Leslie cube. Seen from the center of this aperture, the bolometer occupied, then $\frac{a}{2\pi r^2} = 0{\cdot}0000484$ of the hemisphere, and would have received this fraction of the total radiation, except that being placed exactly opposite the radiating surface, more than the mean radiation fell on it in a proportion which calculation shows to be about $\frac{1}{4}$. The fraction of the total radiation which it actually received, then, was 0·0000645 (c).

Accordingly the total radiation would have caused a deflection $\frac{b}{c} = 5300000$ divisions.

The surface of the cube was at a temperature of 99° Cent., and was limited by the diaphragm to an area of 19·6 sq. cm. (d). The total radiation from one centimeter, then, would have caused a deflection of

$\frac{b}{cd} = 270400$ div. The temperature of the bolometer, which was that of the apartment, was 20° C. According to Dulong and Petit's law, the radiation from such a surface at 99° C. to one at 20° C. would be 1·11 cal. per minute (e), which does not greatly differ from our own independent determinations, and for $10^{\text{sec.}} = \overset{\text{min.}}{0{\cdot}167}$ (f) (the time of the galvanometer swing) it equals $\overset{\text{cal.}}{0{\cdot}185}$ (ef). Hence $\frac{b}{cdef} = \frac{270400}{0{\cdot}185} = 1462000$ div. is the potentiality of work in 1 calorie, to be expressed in the swing of the galvanometer needle, and 1 div. $= \overset{\text{cal.}}{0{\cdot}000000684}$.

2. The galvanometer received the fire-fly radiation through a lens which occupied 0·00655 of a hemisphere, and would have transmitted this fraction of the total heat, except for its position, which caused it to transmit ½ more than the average, which is 0·00873 (g). The measured radiation from this fractional part gave $\overset{\text{div.}}{0{\cdot}84}$ div. (h) and $\frac{h}{g} = 96{\cdot}2$ div. is the deflection which would be given by the total abdominal emission, or

$$96{\cdot}2 \times 0{\cdot}000000684 = \overset{\text{cal.}}{0{\cdot}0000658}.$$

Since the luminous surface has an area of about ⅛ sq. cm., this corresponds to a radiation of $\overset{\text{cal.}}{0{\cdot}00039}$ per sq. cm. of radiating surface in the time of the galvanometer needle's swing, or to $\frac{0{\cdot}0004}{f} = \overset{\text{cal.}}{0{\cdot}0024}$ per sq. cm. per minute.

(Taking the water-equivalent of the bulb of an ordinary mercurial thermometer 1 cm. in diameter at $\overset{\text{gr.}}{0{\cdot}25}$ we find

$$\frac{0{\cdot}84 \times {\cdot}000000684}{0{\cdot}25} = 0^{\circ}{\cdot}0000023,$$

showing that if such a thermometer were placed in the position occupied by the bolometer its rise during the time of the latter's exposure to the radiation of the insect would be between two and three one-millionths of a centigrade degree.)

Note, 1901.

These notes, added to the preceding article with the assistance of Dr. H. C. Bolton, are simply intended to point out some of the principal additions to our knowledge of the subject which have appeared during the last ten years; and they make no pretension to be in any sense a bibliography.

About one year after publication of the preceding paper Dr. William H. Seaman, of Washington, wrote an article "On the Luminous Organs of

Insects" (Proc. Am. Soc. Micros., 14th meeting), in which he claims that the emission of light by these insects is connected with the process of oxidation. He says: "In several species of luminous insects the structure of the photogenic organs is specially adapted to secure the most copious supply of air throughout the substance of the gland," and he concludes that this peculiar structure is to enable the glands to produce light by the action of oxygen, the energetic principle of the air.

Lophin ($C_{21}H_{16}N_2$) exhibits this phenomenon at the low temperature of 10° C., in the presence of oxygen and alkalies.

The identity of the light from living beings and that from carbon compounds has been established by spectroscopic observation. The caustic alkali, which is incompatible with organic life, can be replaced by cholin, neurin, and other bodies that are known constituents of living beings.

The quantity of these materials required to produce light is very small; 1.82 grams of lophin dissolved in 25cc. strong alcoholic potash gave light for 20 days throughout its entire mass.

The Russian experimenter extracted with ether from the bodies of 180 *Pelagia noctiluca* a thick yellow liquid that shone beautifully on shaking with an alkali.

In 1893 Raphael Dubois,* whose monograph, "Les Elaterides lumineux" (Bull. Soc. Zoölog., 1886) has been cited, published a paper recording his observations on a myriapod from Algeria, *Orya barbarica* (C. R., cxvii, 184). He confirmed the statement of M. Gazagnaire, who had observed (in May, 1888) that the phosphorescent substance is secreted by these insects on the sternal and episternal plates as a yellowish viscid liquid. The excretion is distinctly acid, a fact that disproves, he says, the oxidation theory, and he gives to the substance the name "luciferine."

Peter Schmidt, of St. Petersburg, published a paper in Russian "On the luminosity of Midges," which was reproduced in 1895, in the Annals and Magazine of Natural History (series 6, vol. 25, p. 133). Schmidt divides luminous insects into two classes: A, those provided with special luminous organs, and, B, those having luminous micro-organisms living upon them. He places midges in the latter group.

In 1896 H. Muraoka examined lampyrid beetles collected in Kyoto, Japan, and found they emitted both actinic and Röntgen rays; he noted reflection of the rays, but was unable to determine refraction, interference, and polarization. Muraoka found the entire body actinically active, and to increase the light sprinkled the insects with water; he also observed that the dead beetles were luminous when kept moist and when rubbed. (Wied. Ann. Phys., vol. 59, p. 773.)

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*See also paper by Dubois on Physiological Light in Smithsonian Report for 1895.

No attempt is here made at a complete bibliography, but the following papers may be consulted by the reader:

C. Verhoeff; Zur Biologie von *Phosphænus hemipterus* und Verwandten. Verh. Ver. Rheinland, 1894, 208.

W. L. Distant; (Luminosity of Fulgoridæ.) Trans. Entomol. Soc. London, 1895, 429.

A. S. Packard; Phosphorescence of Organs of Insects. J. N. Y. Entomol. Society, 1896, 61.

R. Dubois; Les œufs lumineuses et leurs larves. Leçons de physiologie generales et comp. xii, Paris, 1898, p. 301.

Besides these biologic sources of light, there have been discovered several kinds of mineral matter possessing the extraordinary power of emitting visible, actinic, and skiagraphic rays. Becquerel, in 1896, announced that all salts of uranium, whether fluorescent or not, yield invisible radiations capable of discharging electrified bodies and of producing skiagraphic images on photographic plates; and this property persisted even after long confinement in a double leaden box.

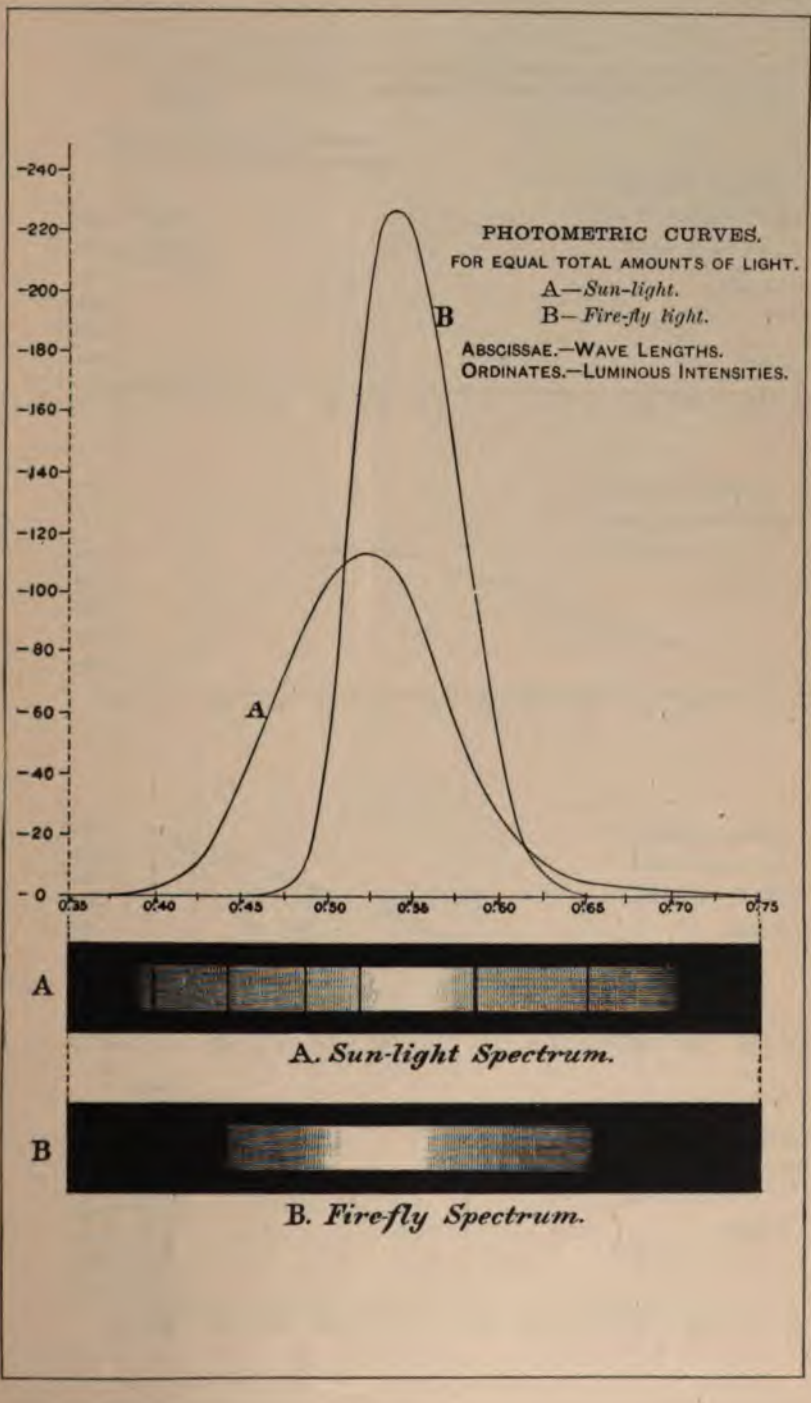
Two years later Mme. Sklodowska Curie, of Paris, having examined a series of uranium minerals, found in pitchblende a substance emitting Becquerel rays, so called, 4,000 times stronger than uranium compounds, and named the element believed to be contained therein "polonium." A few months later M. and Mme. Curie announced a second body having similar properties; this they called "radium." Not long after, a third element, "actinium," was added to the list. Radium, which is the best known, is analogous to barium and accompanies it in chemical reactions so closely that the two have not been satisfactorily separated.

I have, with Dr. H. C. Bolton, verified the fact that the rays given out by small amounts of radium compounds not previously insolated yield, under favoring circumstances, photographic transparencies very clear in details; they also exert chemical action, and they excite fluorescence in barium-platino-cyanide screens even through plates of vulcanite, aluminium, etc., like Röntgen rays. These radio-active bodies have been studied by physicists and chemists for several years, but without success, in isolating the elements or in demonstrating the true source of the energy manifested.

PLATE I

PYROPHORUS NOCTILUCUS

TWICE NATURAL SIZE

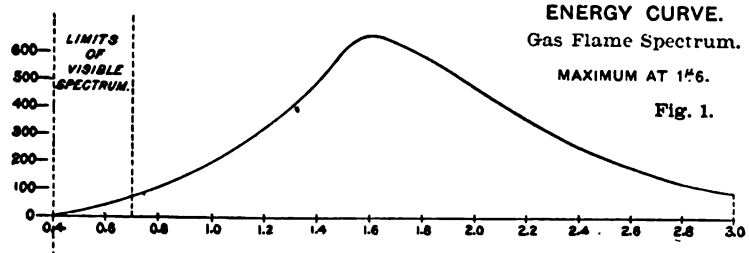


A. *Sun-light Spectrum.*

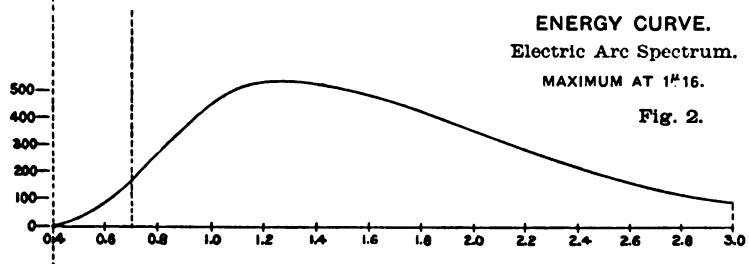
B. *Fire-fly Spectrum.*

Four Curves of Equal Areas, showing one unit of heat displayed successively in heat spectrum of Gas, Electric Arc, Sun and Fire-Fly.

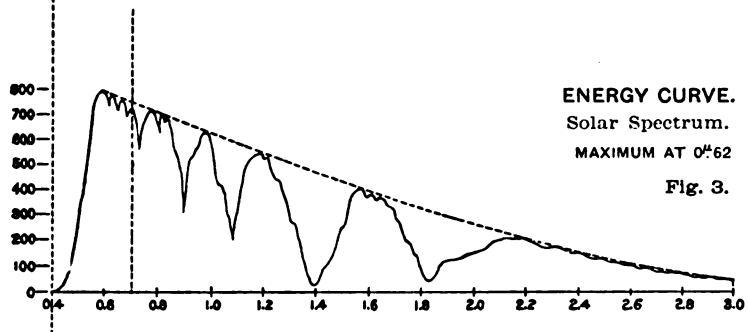
ABSCISSAE. — WAVE LENGTHS.
ORDINATES. — ENERGY AS HEAT.



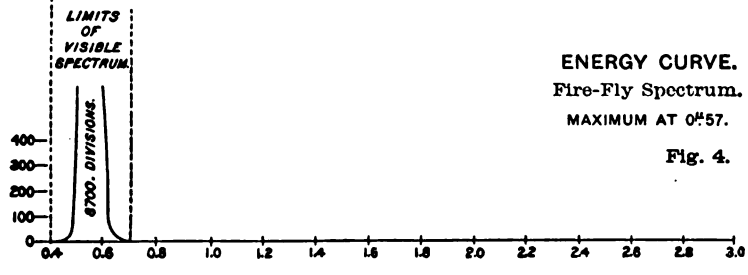
ENERGY CURVE.
Gas Flame Spectrum.
MAXIMUM AT 1μ6.
Fig. 1.



ENERGY CURVE.
Electric Arc Spectrum.
MAXIMUM AT 1μ16.
Fig. 2.



ENERGY CURVE.
Solar Spectrum.
MAXIMUM AT 0μ62
Fig. 3.



ENERGY CURVE.
Fire-Fly Spectrum.
MAXIMUM AT 0μ57.
Fig. 4.

SMITHSONIAN MISCELLANEOUS COLLECTIONS

—1259—

LIST

OF

OBSERVATORIES

CITY OF WASHINGTON
PUBLISHED BY THE SMITHSONIAN INSTITUTION
1902

The Lord Baltimore Press
THE FRIEDENWALD COMPANY
BALTIMORE, MD., U. S. A.

LIST OF OBSERVATORIES.

EXPLANATION OF SYMBOLS.

O—Chiefly engaged in astronomy of position.

AP—Chiefly engaged in astrophysical work.

Met—Conducts meteorological observations.

Mag—Conducts magnetic observations.

I—For purposes of instruction.

An asterisk prefixed signifies that the observatory is one whose position is given in the *American Ephemeris and Nautical Almanac for 1904*.

Meteorological stations are so numerous that it is not within the scope of this list to include them all, but only the more considerable. Observatories included for other reasons may occasionally receive the symbol Met where the meteorological observations alone would hardly justify an additional title.

Although many letters were sent to directors of observatories asking for information useful in the preparation of this list, and a very gratifying and painstaking response was made in most cases, it is realized that it is far from being complete and accurate, especially in the use of symbols. In the interest of greater usefulness it is requested that notices of errors and additions may be sent to the Smithsonian Institution by those who may have occasion to employ the list.

UNITED STATES OBSERVATORIES.

AKRON, Ohio.
Buchtel College Observatory ..... I Met

*ALBANY, New York.
Dudley Observatory ..... O

ALBION, Michigan.
Albion College Observatory.

*ALFRED, New York.
Alfred University Observatory ..... O

*ALLEGHENY, Pennsylvania.
Allegheny Observatory ..... O AP

ALLIANCE, Ohio.
Mount Union College, Morgan Observatory.

AMHERST, Massachusetts.
Amherst College, Lawrence Observatory ..... O

*ANN ARBOR, Michigan.
Detroit Observatory ..... O

*ANNAPOLIS, Maryland.
United States Naval Academy Observatory I

APPLETON, Wisconsin.
Lawrence University, Underwood Observatory ..... O I

ATCHISON, Kansas.
Midland College Observatory ..... O I

BALDWIN, Kansas.
U. S. Coast and Geodetic Survey Base Station ..... Mag

BALTIMORE, Maryland.
Johns Hopkins University Observatory ..... I AP
Private Observatory of John R. Hooper.
Private Observatory of W. H. Numsen.
Private Observatory of Sullivan Pitts.
Private Observatory of Justice Stahn.

BARNESVILLE, Ohio.
Olney Observatory.

BATTLE CREEK, Michigan.
High School Observatory.

*BELOIT, Wisconsin.
Beloit College, Smith Observatory ..... O

*BERKELEY, California.
University of California, Students' Observatory ..... O I

BETHLEHEM, Pennsylvania. (See SOUTH BETHLEHEM.)

BLOOMINGTON, Illinois.
Illinois Wesleyan University Observatory I

BLOOMINGTON, Indiana.
Indiana University, Kirkwood Observatory ..... O

BLUE HILL, Massachusetts. (See HYDE PARK.)

*BOSTON, Massachusetts.
Boston University Observatory (12 Somerset Street).

BOULDER, Colorado.
University of Colorado Observatory I

BROOKLAND, District of Columbia. (See WASHINGTON, D. C., Catholic University.)

BROOKLYN, New York.
Polytechnic Institute Observatory.
Private Observatory of Mr. W. T. Gregg.
Private Observatory of Mr. H. M. Parkhurst..... AP
Private Observatory of Mr. James W. Ward.

BRUNSWICK, Maine.
Bowdoin College Observatory I

BUFFALO, New York.
Private Observatory of Mr. Henry Mills.

*CAMBRIDGE, Massachusetts.
Harvard College Observatory ..... AP O Met

CAMBRIDGEPORT, Massachusetts.
Private Observatory of Mr. E. F. Sawyer.

CARLINVILLE, Illinois.
Blackburn University, Minton Observatory.

CARLISLE, Pennsylvania.
Dickinson College Observatory.

CHAMPAIGN, Illinois. (See URBANA.)

CHARLESTON, South Carolina.
College of Charleston Observatory.

CHARLOTTESVILLE, Virginia. (See UNIVERSITY OF VIRGINIA.)

CHELTENHAM, Maryland.
United States Coast and Geodetic Survey, Principal Magnetic Base Station ..... Mag Met

CHESTER, Pennsylvania.
Pennsylvania Military College, Theodore Hyatt Memorial Observatory.

CHICAGO, Illinois. (See also EVANSTON and WILLIAMS BAY.)
University of Chicago, Students' Observatory ..... O I

*CINCINNATI (Station O), Ohio.
Cincinnati Observatory ..... O

CLAREMONT, California.
Pomona College Observatory ..... I Met

CLEVELAND, Ohio.
Case School of Applied Science, Case Observatory ..... O
Ignatius College Observatory ..... Met
Private Observatory of Dr. John N. Stockwell.
Private Observatory of Warner and Swasey.
Western Reserve University Observatory.

*CLINTON, New York.
Hamilton College, Litchfield Observatory ..... O

COLLEGE PARK, California.
University of the Pacific, Jacks-Goodall Observatory ..... O

COLORADO SPRINGS, Colorado.
Colorado College Observatory ..... I Met

*COLUMBIA, Missouri.
University of the State of Missouri, Laws Observatory ..... O

COLUMBUS, Ohio.
Ohio State University, Emerson McMillan Observatory ..... AP
Private Observatory of R. W. McFarlane.

CRETE, Nebraska.
Doane College, Boswell Observatory.

DELAWARE, Ohio.
Ohio Wesleyan University, Perkins Observatory.

DENVER, Colorado. (See UNIVERSITY PARK.)

DES MOINES, Iowa.
Drake University Observatory.

DUBUQUE, Iowa.
Dubuque Observatory.

DUE WEST, South Carolina.
Erskine College Observatory.

EASTON, Pennsylvania.
Lafayette College Observatory ..... O

ECHO MOUNTAIN, California.
Lowe Observatory ..... O

ELIZABETH, New Jersey.
Observatory of Mr. Charles W. Plyer.

ELMIRA, New York.
Elmira College Observatory.

EVANSTON, Illinois.
Northwestern University, Dearborn Observatory ..... O
Private Observatory of Dr. Marshall D. Ewell.

FAYETTE, Iowa.
Upper Iowa University Observatory.

FLAGSTAFF, Arizona.
Lowell Observatory ..... O AP

FORDHAM, New York. (See RIVERDALE.)

FORT DODGE, Iowa.
Private Observatory of Mr. F. Hess.

FORT WORTH, Texas.
Fort Worth University Observatory.

GAITHERSBURG, Maryland.
International Latitude Observatory ..... O

GALESBURG, Illinois.
Knox College Observatory ..... O

GAMBIER, Ohio.
Kenyon College Observatory ..... O

GENEVA, New York.
Smith Observatory ..... AP

GEORGETOWN, District of Columbia. (See WASHINGTON, D. C.)

GETTYSBURG, Pennsylvania.
Pennsylvania College Observatory.

*GLASGOW, Missouri.
Morrison Observatory ..... O

GRAND RAPIDS, Michigan.
West Michigan College Observatory I

GREENCASTLE, Indiana.
McKim Observatory ..... O

GRINNELL, Iowa.
Iowa College Observatory.

HANOVER, Indiana.
Hanover College Observatory.

*HANOVER, New Hampshire.
Dartmouth College, Shattuck Observatory ..... O AP

HARTFORD, Connecticut.
Trinity College Observatory ..... O

*HAVERFORD, Pennsylvania.
Haverford College Observatory ..... O

HOPKINTON, Iowa.
Lenox College Observatory.

HYDE PARK, Massachusetts.
Blue Hill Meteorological Observatory (A. L. Rotch)..... Met

IOWA CITY, Iowa.
State University of Iowa Observatory ..... O I

IRVINGTON, Indiana.
Butler College Observatory.

ITHACA, New York.
Cornell University Observatory ..... O I Mag

LANCASTER, Pennsylvania.
Franklin and Marshall College, Daniel Scholl Observatory....O I

LANSING, Michigan.
State Agricultural College Observatory.

LAWRENCE, Kansas.
Kansas State University Observatory.

LEBANON, Ohio.
National Normal University, Clark Observatory.....I

LEWISBURG, Pennsylvania.
Bucknell University Observatory.

LINCOLN, Nebraska.
University of Nebraska Observatory I

LINWOOD, Ohio.
Private Observatory of R. H. McClure.

LOS ANGELES, California.
Private Observatory of B. R. Baumgardt.

McMINNVILLE, Oregon.
McMinnville College Observatory.

*MADISON, Wisconsin.
University of Wisconsin, Washburn Observatory.....O AP

MARE ISLAND, California.
Mare Island Observatory .....O

MARIETTA, Ohio.
Marietta College, Gurley Observatory I

MEADVILLE, Pennsylvania.
Allegheny College, Newton Observatory I

*MIDDLETOWN, Connecticut.
Wesleyan University Observatory I

MINNEAPOLIS, Minnesota.
University of Minnesota Observatory .....O

MITCHELL, South Dakota.
Dakota University Observatory.

*MOUNT HAMILTON, California.
University of California, Lick Observatory.....O AP Met

MOUNT LOOKOUT, Ohio. (See CINCINNATI.)

*NASHVILLE, Tennessee.
Vanderbilt University Observatory.

NEW BRUNSWICK, New Jersey.
Rutgers College Observatory.

*NEW HAVEN, Connecticut.
Yale University, Winchester Observatory .....O AP

NEW ORLEANS, Louisiana.
Tulane University Observatory I

NEW YORK, New York.
*Columbia University Observatory .....O
N. Y. Meteorological Observatory (Central Park).....Met

NEWINGTON, Connecticut.
Private Observatory of Mr. D. W. Edgecomb.

NORTHAMPTON, Massachusetts.
Smith College Observatory.

*NORTHFIELD, Minnesota.
Carleton College, Goodsell Observatory .....O AP

NOTRE DAME, Indiana.
Notre Dame University Observatory.

*OAKLAND, California.
Chabot Observatory .....O

OMAHA, Nebraska.
Creighton College Observatory .....O

ORONO, Maine.
University of Maine Observatory .....O I

OXFORD, Mississippi. (See UNIVERSITY, Mississippi.)

PARKVILLE, Missouri.
Park College, Charles Smith Scott Observatory.....O I

PELLA, Iowa.
Private Observatory of R. R. Beard.

PHILADELPHIA, Pennsylvania.
Philadelphia Astronomical Observatory (formerly High School Observatory) .....O AP
*University of Pennsylvania, Flower Astronomical Observatory..O

*POUGHKEEPSIE, New York.
Vassar College Observatory ..... O

*PRINCETON, New Jersey.
Halsted Observatory ..... O AP
John C. Green School of Science Observatory ..... O

*PROVIDENCE, Rhode Island.
Brown University, Ladd Observatory ..... O AP
Seagrave Observatory ..... O

RALEIGH, North Carolina.
Private Observatory of Col. A. W. Shaffer.

READVILLE, Massachusetts. (See HYDE PARK.)

RICHMOND, Indiana.
Earlham College Observatory.

RIVERDALE, New York.
Private Observatory of Mr. William Meikleham.

ROCHESTER, New York.
Warner Observatory. (Closed.)

*SAINT LOUIS, Missouri.
Washington University Observatory ..... O

*SAN FRANCISCO, California.
Davidson Observatory ..... O

SAN JOSÉ, California. (See MOUNT HAMILTON.)

SANTA CLARA, California.
Santa Clara College Observatory ..... O

SEATTLE, Washington.
University of Washington Observatory.

SITKA, Alaska.
United States Coast and Geodetic Survey Base Station..... Mag

*SOUTH BETHLEHEM, Pennsylvania.
Lehigh University, Sayre Observatory ..... O

*SOUTH HADLEY, Massachusetts.
Mount Holyoke College Observatory I

SPICELAND, Indiana.
Private Observatory of Mr. William Dawson.

SWARTHMORE, Pennsylvania.
Swarthmore College Observatory I

*SYRACUSE, New York.
Syracuse University, Holden Observatory.

TARRYTOWN, New York.
Private Observatory of Mr. Charles H. Rockwell..... O

*TROY, New York.
Rensselaer Polytechnic Institute Observatory ..... O

*UNIVERSITY, Alabama.
University of Alabama Observatory.

*UNIVERSITY, Mississippi.
University of Mississippi Observatory.

*UNIVERSITY OF VIRGINIA, Virginia.
University of Virginia, Leander McCormick Observatory. O AP I

*UNIVERSITY PARK, Colorado.
University of Denver, Chamberlin Observatory ..... O

UPLAND, Indiana.
Taylor University Observatory I

UPPER DARBY, Pennsylvania. (See PHILADELPHIA, Flower Observatory.)

URBANA, Illinois.
University of Illinois Observatory ..... O

VEVAY, Indiana.
Private Observatory of Mr. Charles G. Boerner.

WAKE FOREST, North Carolina.
Wake Forest College Observatory I

WASHINGTON, District of Columbia.
*Catholic University of America Observatory ..... O
*Georgetown University Observatory ..... O AP
*Smithsonian Institution Astrophysical Observatory ..... AP
United States Army Engineer School Observatory.
*United States Naval Observatory ..... O Met
United States Weather Bureau..... Met

WASHINGTON, Pennsylvania.
Washington and Jefferson College Observatory.

WATERVILLE, Maine.
Colby College, Shannon Observatory.

WELLESLEY, Massachusetts.
Wellesley College, Whitin Observatory ..... O

WEST POINT, New York.
United States Military Academy Observatory..... I

WILLETS POINT, New York. (See WASHINGTON, D. C., Engineer School Observatory.)

WILLIAMS BAY, Wisconsin.
University of Chicago, Yerkes Observatory ..... O AP

*WILLIAMSTOWN, Massachusetts.
Williams College, Field Memorial Observatory ..... O

WILMINGTON, North Carolina.
Private Observatory of Mr. Eugene Martin.

WILMINGTON, Ohio.
Wilmington College Observatory.

WOOSTER, Ohio.
University of Wooster Observatory I

YANKTON, South Dakota.
Yankton College, Clarke Observatory.

YPSILANTI, Michigan.
State Normal School Observatory.

FOREIGN OBSERVATORIES.

AACHEN, Germany.
Meteorologisches Observatorium ..... Met

ABBADIA, France. (See HENDAYE.)

ABERDEEN, Scotland. (See DUN ECHT.)

*ADELAIDE, South Australia.
Observatory ..... O Met

AGINCOURT, Canada. (See TORONTO.)

AIGOUAL, France. (See MONTPELLIER.)

*ALGER, Algeria.
Observatoire à Bourzareah ..... O AP Met
Service Météorologique de l'Algérie.

ALGIERS, Algeria. (See ALGER.)

ALLAHABAD, India.
Office Meteorological Reporter for Northwest Provinces and Oudh ..... Met

ALTENBURG, Germany.
Sternwarte.

ALT KRASNE, Austria-Hungary.
Meteorolog. Observatorium des Neutrathaler Landwirthschaftlichen Vereins ..... Met

ALTONA, Germany. (See KIEL.)

AMSTERDAM, Netherlands.
Filiale des Kgl. Niederländischen Meteorologischen Instituts. Met

ANTANANARIVO, Madagascar.
Observatoire Royal ..... Mag

*AREQUIPA, Peru.
Harvard College Observatory (Arequipa Station) ..... O AP

*ARMAGH, Ireland.
Observatory ..... O

*ATHENS, Greece.
Observatoire National d'Athénes ..... O Met

AUCKLAND, New Zealand.
Meteorological Observatory ..... Met

AVIGNON, France.
Observatoire Météor. du Mont-Ventoux ..... Met

BAGNÈRES-DE-BIGORRE, France.
Observatoire du Pic du Midi ..... Met AP Mag

*BAMBERG, Germany.
Remeis-Sternwarte ..... O Met

BANGALORE, India.
Mysore State Observatory ..... O Met

BARNAUL, Russia.
Meteorologicheskaia Observatoria ..... Met

BASEL, Switzerland.
Astronomisch-Meteorologische Anstalt im Bernoullianum. O Met

BATAVIA, Java.
Koninklijk Magnetisch en Meteorologisch Observatorium ..... Mag Met

BAYONNE, France. (See HENDAYE.)

BEIRUT (Syria), Turkey.
Observatory.

BELFAST, Ireland.
Queen's College Observatory.

BELGRAD, Servia.
Observatoire Astronomique et Météorologique ..... O Met

*BERGEN, Norway.
Bergens Observatorium ..... O Met

BERLIN, Germany. (See also TEGEL.)
*Königliche Universitäts-Sternwarte ..... O
Meteorologisches Institut (Schinkelplatz 6) ..... Met
*Urania Sternwarte ..... O

BERNAL, Argentine Republic.
Observatory ..... Met

BERNE, Switzerland.
*Sternwarte ..... O
Tellurisches Observatorium ..... Mag Met

*BESANÇON, France.
Observatoire Astronomique, Météorologique et Chronométrique de Besançon ..... O Mag Met

BEUIL (Alpes-Maritimes), France.
Annexe de l'Observatoire Bischoffsheim ..... Mag

BEUTHEN, Germany.
Magnetic observations recorded photographically in connection with mining plants ..... Mag

BIDSTON, England. (See LIVERPOOL.)

*BIRR, Ireland.
Birr Castle Observatory ..... O AP Met

BOCHUM, Germany.
Magnetic observations recorded photographically in connection with mining plants ..... Mag

BOGENHAUSEN, Germany.
Königliche Sternwarte ..... O Mag

BOGOTÀ, Colombia.
*Observatorio Astronómico Nacional ..... O
Observatorio Flammarion.

*BOLOGNA, Italy.
Osservatorio Astronomico e Meteorologico ..... O Met

*BOMBAY, India.
Government Observatory at Colaba ..... Mag Met

*BONN, Germany.
Universitäts-Sternwarte ..... O AP

*BORDEAUX, France.
Observatoire Astronomique et Météorologique..... O AP Met

*BOTHKAMP (near Kiel), Germany.
Sternwarte des Herrn Kammerherrn von Bülow..... O AP

BREMEN, Germany.
Meteorologisches Observatorium ..... Met
Observatorium der Navigations-Schule.

*BRESLAU, Germany.
Universitäts-Sternwarte ..... O Met

BREST, France.
Observatoire de la Marine ..... Met

BRIGHTON, England.
Private Observatory of Mr. A. Stanley Williams.....AP

*BRISBANE, Queensland.
Weather Bureau .....Met

BRUSSELS, Belgium. (See BRUXELLES.)

*BRUXELLES, Belgium.
Observatoire Royal de Belgique à Uccle.....O Mag Met

BUCURESCI, Roumania.
Institutul Meteorologic .....Mag Met

BUDAPEST, Austria-Hungary.
*Geodätisches Observatorium des K. Ung. Josephs-Polytechnikums.
K. Ung. Reichsanstalt für Meteorologie und Erdmagnetismus .....Mag Met

BUENOS AIRES, Argentine Republic.
Observatorio Meteorológico del Colegio Pio IX de Artes y Oficios—Almagro .....Met

BUSHEY HEATH, England.
Private Observatory of Mr. J. K. Tarrant, Craven College.

CADIZ, Spain. (See SAN FERNANDO.)

*CAIRO, Egypt.
Observatoire Khédivial. (The Director General, Survey Department, Public Works Department, Cairo, Egypt.).....O

CALCUTTA, India.
Meteorological Office .....Met
Observatory of St. Xavier's College (10 Park Street).....O

CAMBRIDGE, England.
*Cambridge Observatory .....O AP
Observatory of Mr. H. F. Newall .....AP

CAMEN DE PATAGONES, Argentine Republic.
Observatory .....Met

*CAPE TOWN, Cape Colony.
Royal Observatory .....O AP Met

CARACAS, Venezuela.
Observatorio Astronómico .....O Met

CARLSBURG, Austria-Hungary.
Sternwarte.

CASAMICCIOLA, Italy. (See ISCHIA.)

CATANIA, Italy.
*Osservatorio Bellini sull' Etna .....AP Met
R. Osservatorio .....O AP Met

CHANG-HAI, China. (See SHANGHAI.)

CHAPULTEPEC, Mexico. (See TACUBAYA.)

*CHARKOW, Russia.
University Observatory .....O

CHEMNITZ, Germany.
Königlich Sächsisches Meteorologisches Institut .....Met

CHERBOURG, France.
Observatoire de la Marine .....O

CHRISTIANIA, Norway.
Meteorologisk Institut .....Mag Met
*Universitets Observatorium .....O Mag

CHUBUT, Argentine Republic.
Observatory .....Met

CLAUSTHAL, Germany.
Magnetic observations recorded photographically in connection with mining plants .....Mag

CLERMONT-FERRAND, France.
Observatoire Météorologique du Puy-de-Dôme.....Met
Station Météorologique de Clermont-Ferrand.....Met

COIMBRA, Portugal.
*Observatorio Astronomico da Universidade .....O
Observatorio Meteorologico da Universidade de Coimbra.Mag Met

COLABA, India. (See BOMBAY.)

COLLOONEY, Ireland. (See MARKREE.)

COLLURANIA, Italy. (See TERAMO.)

COLOMBO, Ceylon.
Surveyor General's Office .....Met

CONSTANTINOPLE, Turkey.
Observatoire Impérial Météorologique .....Met

COPENHAGEN, Denmark. (See KJÖBENHAVN.)

CORDOBA, Argentine Republic.
*Observatorio Nacional Argentino ..... O
Oficina Meteorológica Argentina ..... Met

CORK, Ireland.
Observatory of Queen's College.

COURGNÉ (Torino), Italy.
Osservatorio del Collegio Salesiano ..... Met

CRACOW, Austria-Hungary. (See KRAKOW.)

CRONSTADT, Russia. (See KRONSTADT.)

*CROWBOROUGH, Sussex, England.
Starfield Observatory, Dr. Isaac Roberts ..... AP

CURITYBA (Paraná), Brazil.
Meteorological Observatory of the Telegraph Department.... Met

CUYABÁ (Matto Grosso), Brazil.
Observatorio Meteorologico do Collegio Salesiano..... Met

CZERNOWITZ, Austria-Hungary.
Landwirthschaftliche Landes-Mittelschule ..... Met

*DANZIG, Germany.
Observatorium der Naturforschenden Gesellschaft..... O

DARAMONA, Streete, Co. Westmeath, Ireland.
Private Observatory of Mr. W. E. Wilson..... AP

DAR-ES-SALAM, East Coast Africa.
Magnetic Survey of German Colonies, Base Station..... Mag

DE BILT, Netherlands. (See UTRECHT.)

DEHRA DÛN, India.
Magnetic, Trigonometrical and Photoheliographic Survey of India, Base Station ..... AP Mag Met

DERPT, Russia.
*Imperatorskaia Astronomicheskaia Observatoria ..... O
Meteorologisches Observatorium ..... Met
Physikalisches Observatorium der Universität ..... AP

DORPAT, Russia. (See DERPT.)

*DRESDEN, Germany.
Königlicher Mathematisch-Physikalischer Salon.

*DUBLIN, Ireland.
Trinity College, Dunsink Observatory.....O

*DUN ECHT, Scotland.
Dun Echt Observatory (Removed to Royal Observatory, Edinburgh).

DUNSINK (County Dublin), Ireland. (See DUBLIN.)

*DURBAN, Natal.
Government Observatory .....O Met

*DURHAM, England.
University Observatory .....O Met

*DÜSSELDORF, Germany.
Sternwarte (Martinstrasse 101) .....O

EALING (London W.), England.
Observatory of Dr. A. A. Common (63 Eaton Rise).....O

EDINBURGH, Scotland.
*City Observatory, Calton Hill.
*Royal Observatory, Blackford Hill.....O AP
Scottish Meteorological Society (122 George Street).....Met

EKATERINBURG, Russia. (See KATHARINENBURG.)

ELSFLETH, Germany.
Observatorium der Navigations-Schule.

ETNA, Italy. (See ETNEO.)

ETNEO, Sicily, Italy. (See CATANIA.)

FALMOUTH, England.
Observatory .....Mag Met

FIRENZE, Italy.
Osservatorio Ximeniano .....O Met
*Reale Osservatorio Astronomico di Firenze ad Arcetri .....O
*R. Osservatorio Meteorologico del Museo.....Met

FLORENCE, Italy. (See FIRENZE.)

FOGLIZZO (Torino), Italy.
Osservatorio Meteorologico del Collegio Salesiano.....Met

FORT WILLIAM, Scotland.
Ben Nevis Observatory .....Met

FRANKFURT AM MAIN, Germany.
Meteor. Observatorium des Physikalischen Vereins.....Met

FUNCHAL, Madeira.
Observatoire Météorologique .....Met

GALATZ, Roumania.
Privat-Sternwarte.

GEISENHEIM, Germany.
Monrepos Observatorium.

GENEVA, Switzerland. (See GENÈVE.)

*GENÈVE, Switzerland.
Observatoire de Genève .....O

GENOA, Italy. (See GENOVA.)

*GENOVA, Italy.
Osservatorio Meteorologico della Reale Università .....Met
Osservatorio del R. Istituto Idrografico.....O

GEORGETOWN, British Guiana.
Botanic Gardens .....Met

*GLASGOW, Scotland.
Glasgow University Observatory.....O AP Met

*GOHLIS, Germany.
Sternwarte.

*GOTHA, Germany.
Herzogliche Sternwarte .....O

GÖTTINGEN, Germany.
*Königliche Sternwarte .....O AP
Physikalisches Institut, Abteilung für Geophysik .....Mag Met

GRAZ, Austria-Hungary.
Physikalisches Institut der k. k. Carl-Franzens-Universität.
Sternwarte des Herrn Guenat.
*Universitäts-Sternwarte .....O

*GREENWICH (London), England.
Royal Observatory .....O AP Mag Met

*GRIGNON (Côte-d'Or), France.
Observatoire du Prieuré de St. Jean .....AP Met

GRONINGEN, Netherlands.
Astronomical Laboratory of the University .....O

GUATEMALA, Guatemala.
Laboratorio Quimico Central Casa de Moneda .....Met

GUAYAQUIL, Ecuador.
Observatorio Meteorológico del Colegio Nacional, San Vincent .....Met

HABANA, Cuba.
Observatorio del Colegio de Belen .....O Mag Met
United States Weather Bureau .....Met

HAÏPHONG, Indo-China.
Observatoire Central de Phu lien.....O Met Mag

HALIFAX, England.
Bermerside Observatory of Mr. Edward Crossley .....O Met

HALLE AN DER SAALE, Germany.
Universitäts-Sternwarte .....O

HAMBURG, Germany.
Deutsche Seewarte .....Met
*Sternwarte .....O

HAVANA, Cuba. (See HABANA.)

*HEIDELBERG, Germany.
Grossherzogliche Sternwarte .....O AP

HELSINGFORS, Finland, Russia.
*Astronomiska Observatoriet .....O
Meteorologiska Central-Anstalt .....Mag Met

HENDAYE, France.
Observatoire Antoine d'Abbadie .....O Met

*HERÈNY (near Steinamanger), Austria-Hungary.
Astrophysikalisches Observatorium .....AP

HERMSDORF (near Waldenburg), Germany.
Magnetic observations recorded photographically in connection with mining plants .....Mag

HIEN-HIEN, China.
Observatoire de Tchang-kai-tchonang .....Met

HOBART, Tasmania.
Timeball and Meteorological Observatory .....Met

*HONGKONG, China.
Hongkong Observatory .....O Mag Met

HONOLULU, Hawaiian Islands.
Hawaiian Meteorological Office .....Met
U. S. Coast and Geodetic Survey Station .....Mag

ILE TERCEIRA, Azores.
Observatoire Météorologique.

INNSBRUCK, Austria-Hungary.
Physikalisches Institut der k. k. Leopold-Franzens-Universität.O

IRKUTSK (Siberia), Russia.
Magnetisch-Meteorologisches Observatorium .....Mag Met

ISCHIA, Italy.
R. Osservatorio Geodinamico di Casamicciola.

JAIPUR, India.
Maharajah of Jaipur Observatory .....O Met

JALAPA, Mexico.
Observatorio Meteorológico Central del Estado de Vera Cruz.Met

*JENA, Germany.
Sternwarte und Meteorologisches Institut .....O Met

JUIZ DE FORA, Brazil.
Meteorological Observatory of the Hygiene Municipal Office..Met

JUVISY, France.
Observatoire de Camille Flammarion .....O Met

*KALOCSA, Austria-Hungary.
Haynald-Observatorium .....O AP

KARLSRUHE, Germany.
Central-Bureau für Meteorologie und Hydrographie.....Met
*Grossherzogliche Sternwarte (moved to Heidelberg in 1896).

KATHARINENBURG (Siberia), Russia.
Observatoire Magnétique et Météorologique .....Mag Met

KAZAN, Russia.
*Astronomischeskaia Observatoria Imperatorskago Kazanskago Universiteta .....O Mag Met
Observatoire-Engelhardt .....O Mag Met

*KEW, England. (See also RICHMOND.)
Magnetic and Meteorological Observatory .....Mag Met

KHARKOFF, Russia.
Astronomisches Observatorium ..... O
Meteorologisches Observatorium ..... Met

KIEF, Russia.
Astronomisches Observatorium ..... O
Meteorologisches Observatorium ..... Met

*KIEL, Germany.
Königliche Sternwarte ..... O

KIMBERLEY, Cape Colony.
Meteorological Observatory ..... Met

KINGSTON, Canada.
Observatory of Queen's University I

*KINGSTON, Jamaica.
United States Weather Bureau Station..... Met

KJÖBENHAVN, Denmark.
Danske Meteorologiske Institut ..... Mag Met
*Universitets Astronomiske Observatorium ..... O

*KODAIKANAL, India.
Solar Physics Observatory ..... O Mag AP Met

*KÖNIGSBERG, Germany.
Universitäts-Sternwarte ..... O

KORNTHAL (near Stuttgart), Germany.
Magnetic Survey of Württemberg, Base Station.... ..... Mag

*KRAKOW, Austria-Hungary.
K. k. Universitäts-Sternwarte ..... O

*KREMSMÜNSTER, Austria-Hungary.
Sternwarte des Benediktiner-Stiftes ..... O AP Mag Met

KRONSTADT, Russia.
Morskaia Astronomicheskaia Observatoria ..... O

KUMAMOTO, Japan.
Observatory 5th High School, under auspices of Seismological Society ..... Mag

LANCASTER, England.
Observatory I

*LA PLATA, Argentine Republic.
Observatorio Astronómico de la Plata ..... O Mag Met

*LEIDEN, Netherlands.
Rijiks Observatorium .....O

*LEIPZIG, Germany.
Universitäts-Sternwarte .....O

LEMBERG, Austria-Hungary. (See LWÓWIE.)

LEON, Mexico.
Observatorio Meteorológico de Leon .....Met

LEYDEN, Netherlands. (See LEIDEN.)

*LIÈGE, Belgium.
Observatoire Astronomique de l'Université de Liège.....O

LISBOA, Portugal.
Observatorio Astronomico na Escola Polytechnica .....O
Observatorio Meteorologico e Magnetico "Infante Dom Luiz" na Escola Polytechnica .....Mag Met
*Observatorio Naval .....O Mag
*Real Observatorio Astronomico de Lisboa (Tapada) .....O

LISBON, Portugal. (See LISBOA.)

*LIVERPOOL, England.
Liverpool Observatory, Bidston, Birkenhead.....O Met

LOANDA, Angola, Portuguese West Africa.
Observatorio Meteorologico .....Met

LONDON, England. (See also EALING, GREENWICH, SOUTH KENSINGTON and TULSE HILL.)
Meteorological Office (63 Victoria St., S. W.).....Met
Royal Meteorological Society (Princes Mansions, 70 Victoria St., Westminster, S. W.) .....Met

LORIENT, France.
Observatoire de la Marine .....O

LOUVAIN, Belgium.
Observatoire du Collège de la Compagnie de Jésus.....O
Observatoire de M. le Docteur François Terby.

LOVEDALE, Cape Colony.
Private Observatory of Dr. A. W. Roberts.....O

*LÜBECK, Germany.
Sternwarte der Navigations-Schule .....O Met

*LUND, Sweden.
Astronomiska Observatoriet .....O

*LUSSINPICCOLO, Austria-Hungary.
Manora Sternwarte .....O

LWÓWIE (Galicia), Austria-Hungary.
Obserwatoryum C. K. Szkoly politechnicznej.....O Met

*LYME REGIS, England.
Rousdon Observatory (of the late Sir Cuthbert Peek).....O Met

*LYON, France.
Observatoire Astronomique et Météorologique.....O Mag Met

MACHRIHANISH, Campbeltown, Scotland.
Private Observatory of Mr. Franklin Adams.....O

MADRAS, India. (See KODAIKANAL.)

MADRID, Spain.
Instituto Central Meteorológico .....Met
*Observatorio Astronómico .....O Mag Met

MAGDEBURG, Germany.
Wetterwarte der Magdeburger Zeitung .....Met

*MANILA, Philippine Islands.
Observatorio Meteorológico .....O AP Mag Met

MANNHEIM, Germany. (See HEIDELBERG.)

*MARBURG, Germany.
Sternwarte .....Mag Met

*MARKREE, Ireland.
Markree Observatory (of Col. Cooper).....O Mag Met

*MARSEILLE, France.
Observatoire .....O Mag Met

MAURITIUS, ISLAND OF. (See PORT LOUIS.)

*MELBOURNE, Victoria.
Government Observatory .....O Mag Met

MEUDON, France. (See PARIS.)

*MEXICO, Mexico.
Observatorio Meteorológico-Magnetico Central (Palacio Nacional) .....Mag Met

MILAN, Italy. (See MILANO.)

*MILANO, Italy.
R. Osservatorio Astronomico di Brera .....O AP

*MODENA, Italy.
Osservatorio Geofisico della R. Università .....O Mag Met

*MONCALIERI, Italy.
Osservatorio del R. Collegio Carlo Alberto .....Met

MONT BLANC, France.
Observatoire Janssen au Sommet .....AP Met
Observatoire Vallot .....Met

MONTEVIDEO, Uruguay.
Observatorio Meteorológico del Colegio Pio de Villa Colón.O Met

MONT MOURNIER (Alpes-Maritimes), France.
Annexe de l'Observatoire Bischoffsheim.....O Met

MONTPELLIER, France.
Station Météorologique du Mont-Aigoual .....Met

*MONTREAL, Canada.
McGill University Observatory .....O Met

MONTSOURIS, France. (See PARIS.)

MOSCOW, Russia. (See MOSKVA.)

MOSKVA, Russia.
*Astronomicheskaia Observatoria .....O
Meteorologisches Observatorium des Landwirthschaftlichen Instituts .....Met
Meteorologisches Observatorium der Universität.....Mag Met

MÜNCHEN, Germany. (See also BOGENHAUSEN and ZUGSPITZE.)
Königlich Bayerische Meteorologische Central-Station.....Met
*Königliche Sternwarte .....O Mag

MUNICH, Germany. (See MÜNCHEN.)

NAGOYA, Japan.
Meteorological Station (auspices of Seismological Society)...Mag

NANTES, France.
Observatoire du Petit Port .....Mag

NAPLES, Italy. (See NAPOLI.)

NAPOLI, Italy.
*R. Osservatorio Astronomico di Capo di Monte .....O
R. Osservatorio Vesuviano .....Mag Met

NATAL, South Africa. (See DURBAN.)

NEMURO, Japan.
Meteorological Station (auspices of Seismological Society)...Mag

*NEUCHÂTEL, Switzerland.
Observatoire Cantonal .....O

*NICE, France. (See also BEUIL and MONT MOURNIER.)
Observatoire Bischoffsheim .....O AP Mag Met

NICOLAS DE LOS ARROJO, Argentine Republic.
Observatory .....Met

*NIKOLAIEFF, Russia.
Morskaia Astronomicheskaia Observatoria .....O

NORWICH, England.
Private Observatory of Mr. Newbegin .....O

NÜRNBERG, Germany.
Wetterwarte .....Met

OAXACA, Mexico.
Observatorio Meteorológico del Estado de Oaxaca.....Met

OBIR, Karinthia, Austria-Hungary.
Meteorological Observatory .....Met

ODESSA, Russia.
Meteorologisches Observatorium .....Mag Met
*Sternwarte .....O

Ó-GYALLA, Austria-Hungary.
*Astrophysikalisches Observatorium .....AP
Königlich Ungarisches Meteorologisches und Erdmagnetisches Central-Observatorium .....Mag Met

OPORTO, Portugal. (See PORTO.)

ORTHEZ, France.
Observatoire Carlier .....Met

OTTAKRING, Austria-Hungary. (See WIEN, die von Kuffner'sche Sternwarte.)

OUTWOOD, Surrey, England.
Private Observatory of Mr. W. H. Maw .....O

*OXFORD, England.
Radcliffe Observatory .....O
University Observatory .....O AP

*PADOVA, Italy.
Osservatorio Astronomico della R. Università .....O

PADUA, Italy. (See PADOVA.)

*PALERMO, Italy.
R. Osservatorio Astronomico .....O Met

PARC SAINT MAUR, France. (See PARIS.)

PARIS, France.
Bureau Central Météorologique de France.....Mag Met
*Observatoire d'Astronomie Physique de Meudon .....AP
Observatoire Magnétique annexe du Val Joyeux.....Mag
Observatoire de Météorologie Dynamique de Trappes.....Met
*Observatoire Municipal de Paris (Montsouris).....Met
*Observatoire du Parc Saint Maur .....Mag Met
*Observatoire de Paris .....O Mag Met
Observatoire de la Tour St. Jacques.....Met

PARMA, Italy.
R. Osservatorio Astronomico e Meteorologico .....Met
R. Osservatorio Meteorologico e Geodinamico.....Met

PARSONSTOWN, Ireland. (See BIRR.)

PATAGONES, Argentine Republic.
Observatorio Meteorológico del Colegio Salesiano .....Met

PAVIA, Italy.
R. Osservatorio Meteorologico e Geodinamico.....Met

PAVLOVSK, Russia.
Magnetisches und Meteorologisches Observatorium (under Direction of the Central Physical Observatory, St. Petersburg) .....Mag Met

PAYSANDÚ, Uruguay.
Observatorio Meteorológico del Colegio Salesiano .....Met

PEKIN, China.
Imperial College Observatory.
Observatory of the Imperial Russian Embassy .....Mag Met

PERPIGNAN, France.
Observatoire Météorologique Magnétique .....Mag Met

PERTH, Western Australia.
Government Observatory .....O Met

PERUGIA, Italy.
Osservatorio Meteorologico dell' Universita.....Met

PIC DU MIDI, France. (See BAGNÈRES-DE-BIGORRE.)

PISA, Italy.
R. Osservatorio Meteorologico .....O Met

PLONSK, Russia. (See VARSHAVA.)

*POLA, Austria-Hungary.
Marine-Sternwarte .....O Mag Met

PONTA DELGADA (St. Michael), Azores.
Observatorio Meteorologico .....Met

POONA, India.
Takhtasingji Observatory .....O AP

*PORT LOUIS, Mauritius.
Royal Alfred Observatory .....O Mag Met

PORTO, Portugal.
Observatorio meteorologico "Princeza Dona Amelia.".....Met

PORTO ALEGRE, Brazil.
Observatorio Meteorologico .....Met

POTSDAM, Germany.
*Königliches Astrophysikalisches Observatorium .....O AP
Königliches Geodätisches Institut .....O
Königliches Meteorologisches und Magnetisches Observatorium .....Mag Met

PRAG, Austria-Hungary.
*K. K. Universitäts-Sternwarte .....O
Magnetic and Meteorological Observatory .....Mag Met

PRZEMYTL (Galicia), Austria-Hungary.
Private Observatory of Herr Trattnig.....O

PUEBLA, Mexico.
Observatorio Meteorológico del Colegio del Estado.....Met

*PULKOVO, Russia.
Nikolaiefskaia Glavnaia Observatoria .....O AP

SIDMOUTH, England.
Private Observatory of Mr. Lindemann.

SIENA, Italy.
R. Osservatorio Meteorologico della Università.....Met

SIMLA, India.
Meteorological Office .....Met

SOFIA, Bulgaria.
Station Centrale Météorologique .....Met

SONNBLICK (Salzburg), Austria-Hungary.
Wetterwarte .....Met

SOUTH KENSINGTON (London), England.
Solar Physics Observatory .....AP

SOUTHPORT, England.
Fernley Meteorological Observatory .....Met
Observatory of Mr. J. Baxendell .....O AP

SRINAGAR, Kashmir, India.
Kashmir State Observatory .....Met

STARFIELD, England. (See CROWBOROUGH.)

STEINAMANGER, Austria-Hungary. (See HERÉNY.)

STOCKHOLM, Sweden.
Meteorologiska Central-Anstalten .....Met
*Observatorium .....O

STONYHURST, England. (See WHALLEY.)

STRASSBURG, Germany.
*Kais. Universitäts-Sternwarte .....O
Meteorologischer Landesdienst für Elsass-Lothringen.....Met

STUTTGART, Germany. (See also KORNTHAL.)
Königl. Meteorologische Central-Station .....Met

*SYDNEY, New South Wales.
Government Observatory .....O Met

*TACHKENT (Turkestan), Russia.
Observatoire Astronomique et Physique .....O AP Met

*TACUBAYA, Mexico.
Observatorio Astronómico Nacional Mexicano .....O Mag Met

TAI-HO-KU, Formosa, Japan.
Central Observatory.

TAPADA, Portugal. (See LISBOA.)

TEGEL (near Berlin), Germany.
Aeronautical Observatory of the Prussian Meteorological Institute ..... Met

TERAMO, Italy.
Osservatorio Privato Cerulli ..... O
Osservatorio Privato (G. Ciscato) ..... AP
Osservatorio Privato di Collurania ..... O

TIFLIS, Russia.
Tiflisskaia Fizicheskaia Observatoria ..... AP Mag Met

TOKYO, Japan.
*Astronomical Observatory of the Imperial University ..... O
Central Meteorological Observatory ..... Mag Met
Naval Observatory, Hydrographic Office ..... Met

TOLUCA, Mexico.
Red Meteorológica del Estado de Mexico (Apartado Postal 29). Met

*TORINO, Italy. (See also COURGNÉ and FOGLIZZO.)
Reale Osservatorio dell' Università ..... O Met

TORONTO, Canada.
Meteorological Office ..... Met
Observatory at Agincourt (part of the Meteorological Service of Canada) ..... Mag Met
*Toronto Observatory ..... O

TOULON, France.
Observatoire de la Marine ..... Mag

*TOULOUSE, France.
Observatoire de Toulouse ..... O AP Mag Met

TOW LAW, England. (See WOLSINGHAM.)

TRAPPES, France. (See PARIS.)

TREVANDRUM, India.
His Highness the Maharajah's Observatory ..... Mag Met

TRIESTE, Austria-Hungary.
*K. K. Astronomisch und Meteorologisches Observatorium. O Met
Sternwarte des Herrn Krieger.

TRINCOMALEE, Ceylon.
Private Observatory ..... O

TSINTAU, Shantong, China.
Meteorologisches Observatorium ..... Met

*TULSE HILL (London S. W.), England.
Observatory of Sir William Huggins ..... AP

TUNBRIDGE WELLS, England.
Private Observatory of Mr. F. McClean ..... AP

TURIN, Italy. (See TORINO.)

UCCLE, Belgium. (See BRUXELLES.)

UPSALA, Sweden.
*Astronomiska Observatoriet ..... O AP
Meteorologiska Institutionen ..... Met

UTRECHT, Netherlands.
Koninklijk Nederlandsch Meteorologisch Instituut .... Mag Met
*Sterrewacht Zonnenburg ..... O

VALENCIA, Ireland.
Observatory of the London Meteorological Office ..... Met

VALKENBURG, Netherlands.
Observatory of Ignatius College ..... O

VARSHAVA, Russia.
*Astronomicheskaia Observatoria ..... O
Biuro Centralne Sieci Stacyj Meterologicznych (Krakowskie-przedmiście, 66) ..... Met
Obserwatoryum Astronomiczne Imienia Dra Jedrzejewicza (Mokotowska, 6) ..... O

VENEZIA, Italy.
*Osservatorio dell' Istituto Nautico ..... O AP
Osservatorio Meteorologico del Seminario Patriarcale ..... Met

VENICE, Italy. (See VENEZIA.)

VENTOUX (Mont), France. (See AVIGNON.)

VERONA, Italy.
Osservatorio dell' Istituto Tecnico ..... Mag Met

VESUVIUS, Italy. (See NAPOLI.)

VIEDMA, Argentine Republic.
Observatory ..... Met

VIENNA, Austria-Hungary. (See WIEN.)

WÄHRING, Austria-Hungary. (See WIEN.)

WALDENBURG, Germany. (See HERMSDORF.)

WARSAW, Russia. (See VARSHAVA.)

*WELLINGTON, New Zealand.
Colonial Observatory ..... Met

*WHALLEY, England.
Stonyhurst College Observatory ..... AP Mag Met

WIEN, Austria-Hungary.
*Die von Kuffner'sche Sternwarte ..... O
K. K. Central-Anstalt für Meteorologie und Erdmagnetismus ..... Mag Met
*K. K. Universitäts-Sternwarte in Währing ..... O AP
Sternwarte der Technischen Hochschule ..... O
Sternwarte des Barons von Rothschild.
Sternwarte des K. K. Militär-Geographischen Instituts.

*WILHELMSHAVEN, Germany.
Kaiserliches Marine-Observatorium ..... O Mag Met

*WINDSOR, New South Wales.
Private Observatory of Mr. John Tebbutt ..... O

WOLFENBÜTTEL, Germany.
Meteorological Observatory ..... Met

WOLSINGHAM, England.
Private Observatory of Reverend T. E. Espin ..... O AP

YAMAGUCHI, Japan.
Magnetic Observatory ..... Mag

YEKATERINBOORG, Russia. (See KATHARINENBURG.)

ZACATECAS, Mexico.
Observatorio Astronómico Meteorológico ..... O Met

ZI-KA-WEI, China. (See SHANGHAI.)

ZUGSPITZE, Germany.
Königlich Bäyerische Meteorologische Station (Branch of Central Station, München) ..... O Met

ZURICH, Switzerland.
Meteorologische Central-Anstalt ..... Met
*Sternwarte des Eidg. Polytechnikums ..... O AP Met

INDEX OF TITLES

INDEX OF LOCALITIES

UNITED STATES

FOREIGN

SMITHSONIAN MISCELLANEOUS COLLECTIONS

1312

INDEX TO THE LITERATURE

OF THE

SPECTROSCOPE

(1887–1900, BOTH INCLUSIVE)

[CONTINUATION OF THE PREVIOUS INDEX BY THE SAME AUTHOR PUBLISHED IN 1888]

BY

ALFRED TUCKERMAN

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PREFACE.

In this volume I have continued my Index to the Literature of the Spectroscope, Smithsonian Miscellaneous Collections No. 658 (published in 1888), to the end of the year 1900, after which date the International Committee for Indexing Scientific Literature begins the continuation of the work of cataloguing Spectroscopy. I have been obliged to leave Astronomical Spectroscopy incomplete, for want of space. In other respects I hope this second volume will be considered an improvement on the first.

Alfred Tuckerman.

New York, Feb. 3, 1902.

INDEX TO THE LITERATURE OF THE SPECTROSCOPE.

1887 TO 1900 (BOTH INCLUSIVE).

BY ALFRED TUCKERMAN.

PART I.—AUTHOR-INDEX.

A

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SMITHSONIAN MISCELLANEOUS COLLECTIONS.

1313

A BIBLIOGRAPHY

OF THE

ANALYTICAL CHEMISTRY

OF

MANGANESE.

1785–1900.

BY

HENRY P. TALBOT AND JOHN W. BROWN.

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LETTER OF TRANSMITTAL.

WASHINGTON, May 11th, 1901.

The Committee on Indexing Chemical Literature, appointed in 1882 by the American Association for the Advancement of Science, has voted to recommend to the Smithsonian Institution for publication the following:

"A Bibliography of the Analytical Chemistry of Manganese, 1785–1900," by Henry P. Talbot and John W. Brown.

This forms one of the following series:

Index to the Literature of Uranium, 1785–1885, by Henry Carrington Bolton, 1885.

Index to the Literature of Columbium, 1801–1887, by Frank W. Traphagen, 1888.

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Indexes to the Literature of Cerium and Lanthanum, by W. H. Magee, 1895.

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HENRY CARRINGTON BOLTON,
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The Subject Index has been based upon such an examination of the original articles as was possible with a reasonable expenditure of time, and is based therefore upon the salient points rather than upon minute details, although an attempt has been made to carry the subdivision of subjects as far as possible. Under the heading "Applications of Quantitative Methods" (page 111 *et seq.*),only those references are, in general, included in which the title of the article specifies the material analyzed. This is particularly true of irons, steels, ferromanganese, and spiegeleisen.

We desire to express our obligation to Dr. H. C. Bolton for the permission to make use of his "Index," as well as for assistance in the examination of a file of journals, and to Mr. A. C. Davis for his valuable assistance in the examination of proof-sheets.

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HENRY P. TALBOT.
JOHN W. BROWN.

MASSACHUSETTS INSTITUTE OF TECHNOLOGY,
BOSTON

JANUARY, 1902.

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1785-1900.

BY HENRY P. TALBOT AND JOHN W. BROWN.

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J. für Chem. (Schweigger), **63**, 346; Pharm. Centrbl., **1831**, 800; J. techn. Chem. (Erdmann), **13**, 278.

Treatment with hydrochloric acid, oxidation of sulphurous acid by the chlorine generated, and precipitation of barium sulphate.

1832: 4. DUFLOS, A. Ueber Prüfung der Manganerze auf ihren Sauerstoffgehalt und über den Variocit von Ihlefeld.

J. für Chem. (Schweigger), **64**, 81; Pharm. Centrbl., **1832**, 105.

See 1832: 3.

1832: 5. KASTNER. Scheidung verschiedener Salzbasen.

N. Arch. für Chem. u. Meteorologie, **4**, 433; Pharm. Centrbl., **1832**, 208.

Separation from iron by means of ammonium salts of camphoric and suberic acids.

1832: 6. LIEBIG, J. Ueber Scheidung des Manganoxyduls von Eisenoxyde.

Ann. Chem. (Liebig), **1**, 242; Pharm. Centrbl., **1832**, 347.

Acknowledges correctness of Döbereiner's criticisms. See 1832: 2.

1833: 1. GÖBEL. Verhalten der Ameisensäure zu einiger Metalloxyden und Hyperoxyden.

J. für Chem. (Schweigger), **67**, 76; Pharm. Centrbl., **1833**, 271; Berzelius' Jsb. (1835), **14**, 133.

Determination of peroxide by solution in hydrochloric and formic acids, and absorption of the carbon dioxide liberated.

1833: 2. PLANIAWA. Trennung des Manganoxyds und Eisenoxyds.

* Baumgartner's N. Ztschr., **2**, 241; Pharm. Centrbl., **1833**, 699.

Separation from iron by fusion of the precipitate produced by ammonia with alkali and a nitrate.

1833: 3. ZENNECK. Pneumatische Methode der Untersuchung von Manganerzen auf ihren Superoxydgehalt, nebst Angabe von einigen demnach angestellten Prüfungen.

J. techn. Chem. (Erdmann), **18**, 75; Pharm. Centrbl., **1833**, 959; Am. J. Sci., **29**, 374.

A comparison of gasometric methods, including Berthier's methods, expulsion of oxygen by heating the ore alone, by heating with sulphuric acid, and by heating with sugar; also the measurement of chlorine evolved on treatment with hydrochloric acid, and the measurement of the nitrogen evolved by heating with concentrated hydrochloric acid, with the addition of ammonia.

1834: 1. DEMARÇAY, H. Sur l'emploi des sels insolubles comme moyen de séparation dans l'analyse chimique.

Ann. chim. phys. (2), **55**, 398; Pharm. Centrbl., **1834**, 660; Ann. Chem. (Liebig), **11**, 241.

Separation from iron by boiling a solution to which a few drops of ammonium carbonate solution in excess have been added.

1835: 1. GAY-LUSSAC. Nouvelle instruction sur la chlorométrie.

Ann. chim. phys. (2), **60**, 252; Pol. Centrbl., **1836**, 286; Ann. Chem. (Liebig), **18**, 47; Arch. Pharm., **58**, 128.

Determination of peroxide by solution in hydrochloric acid, passage of the chlorine into potassium hydroxide solution, and titration for the hypochlorite formed with arsenious acid.

1835: 2. PERSOZ, J. Sur l'ordre de tendance des oxides pour les acides et les applications qui en decoulent.

Ann. chim. phys. (2), **58**, 199; Pharm. Centrbl., **1835**, 437.

Separation from iron, nickel, and cobalt by means of mercuric oxide.

1836: 1. KRASKOWITZ. Manganreaction.

Ann. der Phys. (Pogg.), **36**, 565; Pharm. Centrbl., **1836**, 175; Arch. Pharm., **58**, 199.

Detection by means of the red produced by hydrochloric acid when brought into contact with the mass after fusion with potassium carbonate.

1836: 2. THOMSON. On minerals containing columbium.

Rec. Gen. Sci., **1836**, 412; Pol. Centrbl., **1836**, 788; Pharm. Centrbl., **1836**, 475; Ann. des Mines (3), **11**, 249; J. prakt. Chem., **9**, 433; Ann. Chem. (Liebig), **19**, 194; J. de pharm. (2), **22**, 440; Dingl. pol. J., **61**, 55; J. Frank. Inst., **22**, 343; Arch. Pharm., **58**, 68 and 132.

Detection by fusion with sodium carbonate. Determination by precipitation as carbonate and ignition to mangano-manganic oxide. Separation from iron by means of benzoates.

1836: 3. WITTSTEIN, G. C. Ueber die Prüfung des käuflichen Braunsteins auf seinen Gehalt an reinen Superoxyd.

Buchner's Repert. (2), **7**, 169; Arch. Pharm., **58**, 199.
Comments on current methods for the valuation of manganese ores.

1837: 1. DÖBEREINER. (Title unknown.)

Berzelius' Jsb., **16**, 159; Chemist, **1**, 237.
Separation from cobalt through differences in solubility of the chlorides in ether.

1837: 2. EBELMEN. Nouveau moyen d'analyse les minerais de manganèse.

Ann. des Mines (3), **12**, 607; Pharm. Centrbl., **1838**, 808; L'Inst. (1838), **6**, 331; J. prakt. Chem., **14**, 312; J. Frank. Inst., **26**, 332.
Determination of peroxide by solution in hydrochloric acid, passage of the chlorine evolved into a solution of sulphurous acid, and precipitation with barium chloride.

1837: 3. RICHTER, W. Trennung des Manganoxyduls von Zinkoxyd.

J. prakt. Chem., **9**, 159; Pharm. Centrbl., **1837**, 90; Ann. des Mines (3), **13**, 460; Ann. Chem. (Liebig), **24**, 309; Berzelius' Jsb., **17**, 190.
Separation from zinc by ignition of the nitrates and treatment of the oxides with acetic acid.

1837: 4. SCHEERER, T. Ueber eine Methode das Kobaltoxyd, sowie das Nickeloxyd und Manganoxyd vom Eisenoxyd, von der Arsenik- und Arsenigen-säure zu trennen. (*Title from Ann. der Phys.* [*Pogg.*].)

Nyt. Mag. Naturvidenskaberne, Physiographiske Forening Christiania, **1840**, 46; Ann. der Phys. (Pogg.), **42**, 104; Pharm. Centrbl., **1838**, 7; J. prakt. Chem., **12**, 354; Ann. des Mines, **13**, 454; Dingl. pol. J., **68**, 463; Arch. Pharm., **66**, 202.
Separation from iron, arsenic and arsenious acids, by precipitation as basic sulphate or chloride.

1838: 1. GIESELER. Prüfung eines im Handel vorkommenden gepulverten Braunsteins auf seinen Gehalt an Manganhyperoxyd und an fremden Bestandtheilen.

Arch. Pharm., **65**, 209.
Comments on Duflos' (1832: 3), Thomson's (1836: 2), and other methods for the determination of peroxide.

1838: 2. WACKENRODER, H. Neue Methode zur Scheidung des Mangans vom Eisen, Nickel, Kobalt und Zink.

Arch. Pharm., **66**, 113; Pharm. Centrbl., **1838**, 673 and 674; **1839**, 193; Berzelius' Jsb. (1840), **19**, 279; Jsb. chem., **1847**, 975.
Separation by means of sulphuretted hydrogen in acetic acid solution, and also by precipitation as sulphides and solution in dilute hydrochloric acid.

1839: 1. FIKENTSCHER, F. C. Prüfung der Braunsteinerze auf Sauerstoffgehalt.

J. prakt. Chem., **17**, 173; Dingl. pol. J., **73**, 204.
Determination of peroxide through loss of weight of strip of copper inserted in the hydrochloric acid during solution of the ore.

1839: 2. FUCHS, J. N. Eisenerzprobe (und Braunsteinprobe) auf nassem Wege.

J. prakt. Chem., **17**, 160; Pol. Centrbl., **1839**, 665.
See Fikentscher, 1839: 1.

1839: 3. W. Trennung von Kobalt und Mangan.

Ann. Chem. (Liebig), **29**, 217; Pharm. Centrbl., **1839**, 384; Ann. des Mines (3), **15**, 431; Arch. Pharm., **74**, 57.
Separation by means of silver nitrate and ammonia.

1841: 1. BERZELIUS. (Title unknown.)

Berzelius' Jsb., **20**, 189.
Treatment with hydrofluoric acid to determine the state of oxidation of manganese in its minerals.

1841: 2. HENRY. (Title unknown.)

* Acad. de Med., **1839**; Pharm. Centrbl., **1841**, 923.
Determination in mineral waters.

1841: 3. LIEBIG, J. Ueber Darstellung und Anwendung des Cyankaliums.

Ann. Chem. (Liebig), **41**, 293.
Separation from cobalt by means of cyanide.

1841: 4. ULLGREN. (Title unknown.)

Berzelius' Jsb., **21**, 147; Chem. Gaz., **1**, 13; Pharm. Centrbl., **1842**, 254; Ann. Chem. (Liebig), **40**, 266; Ann. des Mines (4), **2**, 206.
Separation from nickel and cobalt by precipitation with potassium hydroxide and hypochlorite, solution of the precipitate in hydrofluoric acid, and boiling with ammonia in excess.

1842: 1. LEA, H. C. Remarks upon the Examination of the Peroxide of Manganese.

Am. J. Sci. (1), **42**, 81.
Tests to distinguish manganous from manganic salts.

1842: 2. LEVOL, A. Nouveau moyen d'assai du manganèse.

J. de pharm. (3), **1**, a, 210; Chemist, **3**, 149; Pol. Centrbl., **1842**, 874; Dingl. pol. J., **85**, 299; Ann. des Mines (4), **2**, 205; J. prakt. Chem., **26**, 151; Chem. Gaz., **1**, 329; Ann. Chem. (Liebig), **44**, 355; Arch. Pharm., **81**, 322.

Determination of peroxide by solution of the ore in hydrochloric acid and a ferrous salt, and titration for the excess of the latter with potassium chlorate, using indigo test paper.

1842: 3. OTTO, J. F. Unterscheidung des Zinks von Mangan in Auflösungen welche Ammoniaksalze enthalten.

Ann. Chem. (Liebig), **42**, 347; Pharm. Centrbl., **1842**, 684; Chem. Gaz., **1**, 180; Am. J. Sci. (1), **47**, 194; Ann. des Mines (4), **3**, 569; Berzelius' Jsb., **23**, 242.

Separation by precipitation as sulphide and solution in acetic acid.

1842: 4. OTTO, J. F. Neue Methoden den Chlorkalk und den Braunstein zu prüfen.

Dingl. pol. J., **85**, 296; Pol. Centrbl., **1842**, 876; Chemist, **3**, 346; J. de pharm., **1842**, Mar.

Determination of peroxide by solution in hydrochloric acid and addition of ferrous sulphate, using potassium ferri-cyanide as an indicator.

1843: 1. BAUMANN, H. Prüfung des Braunsteins auf seinen Gehalt an Superoxyd.

Arch. Pharm., **84**, 171; Chem. Gaz., **1**, 499.

Solution of ore in hydrochloric acid and passage of chlorine into a solution of silver nitrate. (It is not evident how this procedure could possibly yield results of any value whatever.)

1843: 2. EBELMEN. Note sur le dosage du manganèse.

Ann. chim. phys. (3), **8**, 508; Ann. des Mines (4), **4**, 409; Pharm. Centrbl., **1844**, 400; Chem. Gaz., **1843**, 685; Ann. Chem. (Liebig), **48**, 369; Arch. Pharm., **90**, 178.

Determination as protoxide by reduction of the higher oxides by ignition in a current of hydrogen.

1843: 3. FRESENIUS, F., and WILL, H. Neue Verfahrungsweisen zur Bestimmung des Werthes der Pottasche und Soda, der Säuren und des Braunsteins.

Ann. Chem. (Liebig), **47**, 87; **49**, 137; Dingl. pol. J., **90**, 219; Pol. Centrbl., **1843**, b, 395; Chem. Gaz., **1844**, 52; Pharm. Centrbl., **1843**, 804; Berzelius' Jsb. (1845), **24**, 261; Buchner's Rep., **83**, 240.

Determination of peroxide by solution with oxalates and absorption of the carbon dioxide.

1844: 1. ETTLING. Chemische Untersuchung des in der Nähe von Giessen vorkommenden Braunsteins.

Ann. Chem. (Liebig), **43**, 185; Berzelius' Jsb., **23**, 243.

Determination of peroxide by the procedure of Gay-Lussac (1835: 1).

1845: 1. CLOEZ. Séparation de l'oxyde de cobalt de l'oxyde de manganèse.

J. de pharm. (3), **7**, 157; Pharm. Centrbl., **1845**, 543; Berzelius' Jsb. (1847), **26**, 277; Chem. Gaz., **3**, 102.

Separation by means of potassium polysulphide.

1845: 2. CRUM, W. Empfindliches Prüfungsmittel auf Mangan.

Ann. Chem. (Liebig), **55**, 219; Pharm. Centrbl., **1845**, 894; Chem. Gaz., **3**, 502; Am. J. Sci. (2), **1**, 262; Ann. des Mines (4), **11**, 496; Ann. der Phys. (Pogg.), **105**, 294; J. de pharm. (3), **9**, 221; Berzelius' Jsb. (1847), **26**, 276.

Oxidation to permanganic acid by means of lead peroxide in nitric acid solution.

1846: 1. BARRESWIL. Sur un nouveau mode de séparation du cobalt d'avec le manganèse.

Ann. chim. phys. (3), **17**, 53; C. R., **22**, 421; Pharm. Centrbl., **1846**, 415; Jsb. Chem., **1847**, 974; Berzelius' Jsb., **27**, 214; Pol. Centrbl., **1847**, 642; **1848**, 1295; Am. J. Sci. (2), **2**, 260; Chem. Gaz., **1846**, 159; J. de pharm. (3), **9**, 189; Ann. des Mines (4), **11**, 499; Dingl. pol. J., **100**, 157; J. prakt. Chem., **38**, 171.

Separation by means of hydrogen sulphide in the presence of barium carbonate.

1846: 2. PHILLIPS, R. A New Test for Manganese.

Chemist, **7**, 152; Am. J. Sci. (2), **2**, 259.

Detection by means of the amethyst color given to solutions in which a piece of phosphorus is partly immersed, the whole being allowed to stand for some time in the dark.

1846: 3. ROWNEY, T. Analysis of the Bohemian Glass as found in the Combustion Tubes employed in Organic Analysis.

Proc. Chem. Soc. (Lond.), **3**, 300.

Determination in glass.

1846: 4. VÖLKER, A. Ueber die rothe Färbung der Manganoxydulsalze.

Ann. Chem. (Liebig), **59**, 27; Pharm. Centrbl., **1846**, 923; Chem. Gaz., **4**, 397.

Separation from cobalt by volatility of the manganous chloride in hydrogen.

1847: 1. BOBIERRE, A. (Title unknown.)

* Monit. Ind., **1847**, No. 1190; Dingl. pol. J., **107**, 448.

Modification of the Gay-Lussac apparatus for the determination of peroxide.

1847: 2. LEVOL, A. Additions concernant une méthode d'assai de manganèse publiée dans ce recueil en Mars 1842.

J. de pharm. (3), **10**, 26; Berzelius' Jsb. (1848), **27**, 213; J. prakt. Chem., **38**, 341.

Determination of the total amount of hydrochloric acid consumed by an ore, as well as the amount oxidized to chlorine. See 1842: 2.

1847: 3. ROSE, H. Ueber die Trennung des Nickels von Kobalt und die beider von anderen Metallen.

Ann. Chem. (Liebig), **64**, 417; Jsb. Chem., **1847**, 974; Ann. der Phys. (Pogg.), **71**, 555.

Separation by means of sulphides and treatment with dilute hydrochloric acid. Comments on Barreswil (1846: 1) and Wackenroder (1838: 2) methods.

1847: 4. STRECKER. Ueber Barreswil's Trennungsmethode des Kobalts von Mangan.

Ann. Chem. (Liebig), **61**, 219; Pharm. Centrbl., **1847**, 367; Jsb. Chem., **1847**, 974; Berzelius' Jsb. (1849), **28**, 179; Pol. Centrbl., **1848**, 1296; Chem. Gaz., **1847**, 205; Am. J. Sci. (2), **4**, 271.

Barreswil method regarded as inefficient. See 1846: 1.

1847: 5. SCHOENBEIN, C. F. Das Ozon als Reagens für Mangan.

Ann. der Phys. (Pogg.), **72**, 466; Jsb. Chem., **1847**, 952, Berzelius' Jsb. (1849), **28**, 180.

Detection through the browning of solutions by ozone.

1847: 6. DE VRY. Bestimmung des Braunsteingehalts.

Ann. Chem. (Liebig), **61**, 249; Pharm. Centrbl., **1847**, 479.

Recommendation of Fresenius-Will method. (1843: 3.)

1849: 1. EBELMEN. Sur un nouveau mode d'emploi de l'hydrogen sulfuré dans l'analyse chimique.

Ann. chim. phys. (3), **25**, 92; Chem. Centrbl., **1849**, 169; Jsb. Chem., **1849**, 592; Berzelius' Jsb. (1851), **30**, 161; J. de pharm. (3), **15**, 266; J. prakt. Chem., **46**, 305; Ann. Chem. (Liebig), **72**, 329; Chem. Gaz., **1849**, 82.

Separation from cobalt, nickel and zinc by heating the oxides in an atmosphere of sulphuretted hydrogen and treatment of the sulphides with acetic or dilute hydrochloric acid.

1850: 1. DAVY, E. (Proceedings.)

Proc. Irish Acad., **4**, 345.

Substance heated with flowers of sulphur, the mass extracted with water, and the manganese precipitated as ferrocyanide.

1851: 1. LAMING, R. On the Quantitative Estimation of Manganese.

Phil. Mag. (4), **1**, 517; Dingl. pol. J., **121**, 77.

Precipitation as carbonate; also a study of the stability of the carbonate.

1851: 2. MÜLLER, L. Prüfung des Braunsteins und Chlorkalks auf deren Gehalt an Mangansuperoxyd und wirksames Chlor.

Ann. Chem. (Liebig), **80**, 98; Pol. Centrbl., **1852**, 312; Jsb. Chem., **1851**, 635; Chem. Centrbl., **1852**, 266; Chem. Gaz., **1852**, 75; Dingl. pol. J., **124**, 50; Arch. Pharm., **121**, 306.

Determination of peroxide by passing chlorine evolved into stannous chloride solution, and titration of the excess of the latter with ferric chloride.

1851: 3. PERSONNE and LHERMITE. Faits pour servir à l'histoire des acides manganique et hypermanganique.

J. de pharm. (3), **19**, 115; Arch. Pharm., **118**, 181.

Determination of peroxide from loss of weight of strip of copper immersed during solution in sulphuric acid.

1851: 4. SCHABUS. Ueber die Anwendung des chromsauren Kalis zur Eisen-, Braunstein- und Chlorkalkprobe.

Wien Akad. Ber., **6**, 406; J. prakt. Chem., **55**, 368; Dingl. pol. J., **125**, 278; Pol. Centrbl., **1852**, 571; Jsb. Chem., **1851**, 634; Ann. Chem. (Liebig), **80**, 360.

Determination of peroxide by solution with ferrous sulphate and titration for the excess of the latter with potassium bichromate.

1852: 1. CHAPMAN. Detection of Manganese in Limestone Rocks.

Phil. Mag., (4) **3**, 144; Chem. Centrbl., **1853**, 16; Chem. Gaz., **1852**, 60; Arch. Pharm., **124**, 168.

Addition of borax necessary for the success of the usual fusion test.

1852: 2. GIBBS, W. Contributions to Analytical Chemistry.

Am J. Sci. (2), **14**, 204; Chem. Gaz., **1852**, 368; Jsb. Chem., **1852**, 728; Chem. Centrbl., **1853**, 105; J. prakt. Chem., **58**, 241; Ann. Chem. (Liebig), **86**, 57 and 62; Ann. chim. phys. (3). **40**, 233; Arch. Pharm., **124**, 168.

Separation from zinc, nickel, the alkaline earths and alkalies, by precipitation from neutral solutions by lead peroxide. Comments on Crum's method of detection. See 1845: 2.

1853: 1. BUNSEN, R. Ueber eine volumetrische Methode von sehr allgemeiner Anwendbarkeit.

Ann. Chem. (Liebig), **86**, 283; Jsb. Chem., **1853**, 626; Chem. Centrbl., **1853**, 545; Ann. chim. phys., (3), **41**, 339.

Determination by solution in hydrochloric acid, passage of the chlorine into potassium iodide solution, and titration of the iodine with sulphurous acid.

1853: 1a. DEVILLE, H. ST. C. Nouvelle méthode generale d'analyse chimique.

Ann. chim. phys. (3), **38**, 5; J. prakt. Chem., **60**, 9.

Separation from alkalies and alkaline earths by ignition of the nitrates and treatment of the residue with dilute nitric acid.

1853: 2. FLAJOLOT. Sur la séparation de quelques oxydes metalliques.

Ann. des Mines (5), **3**, 641; Ann. chim. phys. (3), **39**, 460; Jsb. Chem., **1853**, 678; Chem. Centrbl., **1854**, 156; C. R. **36**, 1090; Chem. Gaz., **1853**, 380; J. prakt. Chem., **59**, 508; **61**, 110.

Separation from cobalt and zinc by precipitation with sodium carbonate in the presence of potassium cyanide.

1853: 3. HEIZEL. (Title unknown.)

Ztschr. für Pharm., **2**, 32; N. Rep. Pharm., **2**, 271.

Comments on Crum's test. See 1845: 2.

1853: 4. HEMPEL, W. Mémoire sur l'emploi de l'acide oxalique dans les dosage à liqueurs titrées. Lusanne, 1853.

Jsb. Chem., **1853**, 629.

Precipitation by means of sodium hypochlorite, solution of the precipitate in oxalic acid and titration for the excess.

1853: 5. KRIEGER, G. Zur volumetrische Bestimmung der Manganverbindungen.

Ann. Chem. (Liebig), **87**, 257; Jsb. Chem., **1853**, 626; Chem. Gaz., **1853**, 450; Am. J. Sci., (2), **17**, 126; J. prakt. Chem., **61**, 472.

See Bunsen, 1853: 1.

1853: 6. LÖWE, J. Ueber die Entdeckung kleiner Mengen von Mangan auf nassem Wege.

Dingl. pol. J., **130**, 436.

Oxidation to permanganic acid by means of sodium hypochlorite.

1853: 7. LÖWENTHAL, J. Versuche über die Trennung des Zinns von anderen Metallen.

J. prakt. Chem., **60**, 259.

Separation from tin by means of sodium sulphate.

1853: 8. MORFIT, C., and BOOTH, J. C. On the Analysis of Cast Iron.

Chem. Gaz., **1853**, 388 and 411; J. prakt. Chem., **61**, 102.

Separation from iron by means of barium carbonate and precipitation as carbonate.

1853: 9. PARKINSON. (Title unknown.)

Ann. Chem. (Liebig), **86**, 62; Jsb. Chem., **1852**, 730.

Confirmation of Gibbs' results. See 1852: 2.

1853: 10. PRICE. On a New Method for the Determination of the Commercial Value of Oxide of Manganese.

Chem. Gaz., **1853**, 416; Pol. Centrbl., **1854**, 111; Dingl. pol. J., **131**, 34; J. prakt. Chem., **60**, 471.

Determination of peroxide by solution in hydrochloric acid, passage of the chlorine into a solution of arsenious acid, and titration for the excess of the latter with permanganate.

1853: 11. RIVOT. (Title unknown.)

Ann. des Mines, 6, 519; Pol. Centrbl., 1853, 821.

Separation from cobalt and nickel.

1853: 12. SCHIEL, T. Separation of Manganese from Iron and Nickel.

Am. J. Sci. (2), 15, 275; Chem. Centrbl., 1853, 528; Pol. Centrbl., 1853, 1512; J. prakt. Chem., 59, 184; Chem. Gaz., 1853, 413; Arch. Pharm., 115, 162.

Precipitation by chlorine in the presence of sodium acetate.

1854: 1. DAVY, E. On Some New and Simple Methods of Detecting Manganese in Natural and Artificial Compounds and of Obtaining its Combinations for Economical Uses.

Proc. Roy. Soc. (Lond)., 6, 385; Jsb. Chem., 1854, 734; Chem. Centrbl., 1854, 415; Chem. Gaz., 1854, 117; Phil. Mag. (4), 7, 222; J. prakt. Chem., 61, 448; Arch. Pharm., 130, 39.

Detection by fusion with potassium hydroxide. Also by ignition with sulphur, oxidation to sulphate, solution, and precipitation with potassium ferrocyanide. See 1850: 1.

1854: 2. STRENG, A. Ueber eine allgemein Anwendbare Bestimmungsmethode auf maassanalytischem Wege.

Ann. der Phys. (Pogg.), 92, 71; Dingl. pol. J., 133, 220; Jsb. Chem., 1854, 720; Chem. Centrbl., 1854, 683; Ann. Chem. (Liebig), 92, 414; Wagner's Jsb., 1, 20; Chem. Gaz., 1854, 271.

Precipitation by means of hypochlorite, solution in stannous chloride, and titration for the excess of the latter with potassium bichromate, using iodo-starch indicator.

1855: 1. MOHR, F. Ueber Oxydations- und Reductionsanalysen.

Ann. Chem. (Liebig), 93, 51; Dingl. pol. J., 135, 289; Wagner's Jsb., 1, 19.

Criticism of Streng's procedure. See 1854: 2.

1855: 2. MÜLLER, L. Chemische Mittheilungen.

Dingl. pol. J., 138, 116.

Criticism of Streng. See 1854: 2.

1855: 3. FRESENIUS, R. Ueber das Trocknen des Braunsteins zum Behuf seine Prüfung.

Ding. pol. J., 135, 277; Pol. Centrbl., 1855, 693 and 745; Wagner's Jsb., 1, 19.

Discussion of the temperature which should be employed to dry pyrolusite before analysis.

1856: 1. GURLT, A. On the Compounds of Carbon and Iron and their Influence on the Production of Pig Iron.

Chem. Gaz., 14, 260.

Separation from iron by means of sodium bicarbonate. Precipitation by potassium hydroxide and ignition.

1856: 2. SCHREINER, E. Prüfung einiger Sorten käuflichen gepulverten Braunsteins.

Vierteljschr. für Pharm. (Wittstein), **5**, 236; Dingl. pol. J., **140**, 105; Pol. Centrbl., **1856**, 955.

Addition of pyrolusite to ferrous sulphate solution until the iron is oxidized. (A crude method.)

1857: 1. BARRESWIL. Sur quelques procédés d'analyse applicable aux recherches mineralogiques.

C. R., **44**, 677; Chem. Centrbl., **1857**, 449; Jsb. Chem., **1857**, 592; L'Inst., **25**, 114; Chem. Gaz., **1857**, 291; J. de pharm. (3), **31**, 342; J. prakt. Chem., **71**, 317; Arch. Pharm., **147**, 46.

Detection by means of the violet color produced by sirupy phosphoric acid or salt of phosphorus.

1857: 2. BÖTTGER, R. Ueber das Verhalten verschiedenen Stoffe zu geschmolzenen reinen chlorsauren Kali.

Rep. für Pharm. (Buchner), **6**, 247; J. phys. Ver. zu Frankfurt, **1856**, 27; J. prakt. Chem., **70**, 433; Chem. Centrbl., **1857**, 635; Jsb. Chem., **1857**, 136; Pol. Centrbl., **1857**, 886; Pol. Notizbl., **12**, 129; Arch. Pharm., **146**, 288.

Detection by the color produced when the substance is brought into contact with fused potassium chlorate.

1857: 3. FIELD, F. On the Separation of Iron and Manganese.

Chem. Gaz., **1857**, 374; Jsb. Chem., **1857**, 592; Dingl. pol. J., **146**, 315.

Separation by means of lead oxide. (PbO).

1857: 4. TERREIL, A. Note sur le dosage du manganèse, du nickel, du cobalt et du zinc.

C. R. **45**, 652; J. de pharm. (3), **32**, 383; Dingl. pol. J., **149**, 265; Jsb. Chem., **1857**, 593; L'Inst., **25**, 366; Chem. Gaz., **1857**, 452; J. prakt. Chem., **73**, 481; Monit. scientif., **1**, 607; Arch. Pharm., **151**, 306.

Influence of ammonium salts on the precipitation as sulphide.

1858: 1. HEMPEL, C. W. Verhalten von Jod- und Bromkalium gegen die höheren Oxyde des Mangans.

Ann. Chem. (Liebig), **107**, 101.

Determination of peroxide by directly heating the substance with potassium iodide and acid, and titration for the iodine liberated.

1858: 2. HENRY, T. H. On the Separation of Nickel and Cobalt from Manganese.

Phil. Mag. (4), **16**, 197; Am. J. Sci. (1869), (2), **47**, 130; Chem. Centrbl., **1859**, 94; Jsb. Chem., **1858**, 619; J. prakt. Chem., **76**, 252.

Separation by means of phosphoric acid in the presence of an excess of ammonia and ammonium chloride.

1858: 3. ROSE, H. Ueber die Lösungen der Manganoxydsalze und über die Walter Crum'sche Reaction insbesondere.

* Monatsber. Akad. Wiss. (Berlin), Nov., **1858**; Rep. für Pharm., **8**, 81.

See title.

1858: 4. SPILLER, J. On Some Remarkable Circumstances Tending to Disguise the Presence of Various Acids and Bases in Chemical Analysis.

J. Chem. Soc. (Lond.), **10**, 114 and 117.

Effect of citrates and grape sugar upon the precipitation of manganese.

1859: 1. FIKENTSCHER, F. C. Prüfung der Braunsteinerze auf Sauerstoffgehalt.

J. prakt. Chem., **17**, 173; Wagner's Jsb., **5**, 65.

Determination of peroxide from the loss of weight suffered by a strip of copper immersed during the solution in hydrochloric acid.

1859: 2. NOLTÉ, G. Untersuchung des Braunsteins auf seinen Gehalt an Mangansuperoxyd.

Berg- u. hüttenm. Ztg., **18**, 149; Ding. pol. J., **152**, 136; Chem. Gaz., **1859**, 288; Pol. Centrbl., **1859**, 1079; Chem. Centrbl., **1859**, 414; Wagner's Jsb., **5**, 65; Arch. Pharm., **157**, 187.

Comments and experiments upon procedure of Fikentscher. See 1859: 1.

1859: 3. VON KOBELL. Ueber die Anwendung des phosphorsauren Manganoxyds in der Titriranalyse, und der Phosphorsäure zur Mineralbestimmung.

J. prakt. Chem., **76**, 415.

Detection by means of violet color produced by phosphoric acid.

1860: 1. FIELD, F. On the Separation of the Oxides of Nickel and Cobalt from Peroxide of Iron.

Chem. News, **1**, 4.

Separation from iron by means of lead oxide (PbO).

1860: 2. GORGEU, A. Sur une combinaison de permanganate et de manganate de potasse.

C. R., **50**, 610.

Precipitation by means of ammonium sulphide and ignition to mangano-manganic oxide.

1860: 3. LENSSEN, E. Volumetrische Bestimmung des Manganoxyduls.

J. prakt. Chem., **80**, 408; Jsb. Chem., **1860**, 655; Chem. Centrbl. **1861**, 78; Rep. chim. pure, **3**, 139.

Volumetric determination by reduction of potassium ferricyanide and titration for the ferrocyanide with permanganate.

1860: 4. MACHNEA, M. Note sur la composition du permanganate de potasse.

C. R., **51**, 140.

Determination by the method of Gay–Lussac. Also by the determination of the chlorine evolved, with the aid of arsenious or sulphurous acid.

1860: 5. ROSE, H. Chemisch-analytische Beiträge; Ueber die Bestimmung der Mengen von Metall in Schwefelverbindungen.

Ann. der Phys. (Pogg.), **110**, 122; Jsb. Chem., **1860**, 644; Chem. Centrbl., **1860**, 583; Ztschr. Chem., **1860**, 557; Rep. chim. pure, **2**, 391.

Precipitation as sulphide and ignition in hydrogen.

1860: 6. ROSE, H. Chemisch-analytische Beiträge; Bestimmung des Mangans; Trennung des Manganoxyduls von Thonerde, Magnesia, Kalkerde und Eisenoxyd.

Ann. der Phys. (Pogg.), **110**, 301; Chem. News, **2**, 266 and 302; J. prakt. Chem., **84**, 23 and 27; Rep. chim. pure, **2**, 457; Arch. Pharm., **161**, 57.

Precipitation as sulphide and weighing as such. Separation from aluminium by means of ammonia in the presence of ammonium chloride; from magnesium and calcium by means of chlorine.

1860: 7. ROSE, H. Chemisch-analytische Beiträge; Trennung des Kobaltoxyds vom Nickeloxyd.

Ann. der Phys. (Pogg.), **110**, 412; Jsb. Chem., **1860**, 656; Ztschr. Chem., **1860**, 622; Rep. chim. pure, **3**, 91.

Separation from nickel or zinc by means of lead peroxide in neutral solution. See Gibbs, 1852: 2.

1861: 1. FRESENIUS, R. Ueber den Einfluss von freiem Ammon und von Ammonsalzen auf die Fällung des Nickels, Kobalts, Zinks, Mangans, Eisens, und Urans durch Schwefelammonium.

J. prakt. Chem., **82**, 257; Chem. Centrbl., **1861**, 525; Chem. News, **4**, 150; Rep. chim. pure, **3**, 66.

Precipitation as sulphide.

1861: 2. KOLBE, H. Directe quantitative Bestimmung der Kohlensäure, kohlensaure Salze, und Braunsteinanalyse.

Ann. Chem. (Liebig), **119**, 129; Dingl. pol. J., **161**, 373.

Determination of peroxide by weighing the carbon dioxide evolved from oxalic acid on solution of pyrolusite.

1861: 3. MOHR, F. Bestimmung der verschiedenen Oxydationsstufen im Braunstein.

Ann. Chem. (Liebig), **117**, 382; Jsb. Chem., **1861**, 850; Rep. chim. pure, **3**, 254.

Determination of the available oxygen in the original specimen and also after ignition.

1865: 2. GIBBS, W. On the Separation of Chromium from Aluminium, Iron, Manganese, Cobalt, Nickel, Zinc, and Magnesium; On the Employment of Acetate of Sodium for the Separation of Iron and Aluminium from other Bases; On the Separation of Manganese from Cobalt, Nickel, and Zinc.

Am. J. Sci. (2), **39**, 58; Ztschr. anal. Chem., **3**, 331; Chem. Centrbl., **1865**, 405; Jsb. Chem., **1865**, 712; J. prakt. Chem., **95**, 356; Ztschr. Chem., **1865**, 307; Dingl. pol. J., **178**, 133; Chem. News, **11**, 101 and 147; Bull. soc. chim. (2), **6**, 126.

Separation from chromium by means of chlorine or lead peroxide in alkaline solution; separation from zinc, cobalt, and nickel by means of sulphuretted hydrogen in acetic acid solution.

1865: 3. HABICH, R. Maassanalytische Bestimmung des Mangans mit übermangansaurem Kali nach Guyard.

Ztschr. anal. Chem., **3**, 474; Jsb. Chem., **1865**, 713; Ztschr. Chem., **1865**, 473; Chem. News, **12**, 58.

Comments on Guyard method. See 1863: 2.

1865: 4. LUCKOW, C. Ueber Elektro-Metallanalyse.

Dingl. pol. J., **177**, 231 and 296; **178**, 42; Jsb. Chem., **1865**, 686.

Precipitation of the peroxide by electrolysis.

1865: 5. RUBE, C. Ueber die Abscheidung des Mangans bei analytischen Arbeiten.

J. prakt. Chem., **94**, 246; Chem. Centrbl., **1865**, 830; Jsb. Chem., **1865**, 711; Ztschr. Chem., **1865**, 347; Ztschr. anal. Chem., **4**, 421; Bull. soc. chim. (2), **4**, 119.

Separation from iron and aluminum by means of mercuric oxide.

1865: 6. WARINGTON, R., Jr. On the Presence of Manganese in Oolite and Lias.

J. Chem. Soc. (Lond.), **3**, 206.

Precipitation by means of chlorine, and ignition to mangano-manganic oxide.

1866: 1. BUNSEN, R. Flammenreactionen.

Ann. Chem. (Liebig), **138**, 291; Phil. Mag. (4), **32**, 104; Jsb. Chem., **1866**, 782; Ztschr. anal. Chem., **5**, 376.

Blowpipe reactions.

1866: 2. EGGERTZ, V. Ueber die Bestimmung des Mangangehaltes in Eisen und Eisenerzen.

* Jern.- Kont. Ann., **1866**, Heft 3; Berg- u. hüttenm. Ztg., **26**, 187; Monit. scient. (1868), **10**, 25; Jsb. Chem., **1868**, 872; * Schweiz. pol. Ztschr., **1867**, 154; Ztschr. Chem., **1868**, 507; Ztschr. anal. Chem., **7**, 495; Bull. soc. chim. (2), **11**, 238; Chem. News, **18**, 232; Wagner's Jsb., **13**, 12.

Separation from iron by the acetate method, precipitation by means of bromine, and drying and weighing of the precipitated peroxide.

1866: 3. FRÖHDE, A. Anwendung des unterschwefligsauren Natrons zur qualitativen und quantitativen Analyse und zur Darstellung von Präparaten.

Arch. Pharm., **177**, 75; Ztschr. anal. Chem., **5**, 396.

Separation from cobalt and nickel by heating with sodium thiosulphate and removing the manganous sulphide by dilute acids.

1866: 4. REICHARDT, E. Ueber die Bestimmung und Scheidung von Manganoxydul, Eisenoxyd und-oxydul.

Ztschr. anal. Chem., **5**, 60; Arch. Pharm., **179**, 234; Vjschr. Pharm. (Wittstein), **16**, 394; Ztschr. Chem., **1866**, 592; Bull. soc. chim. (2), **7**, 495; Jsb. Chem., **1866**, 800.

Separation from ferrous and ferric iron by the acetate method, precipitation as peroxide by means of sodium hypochlorite, and ignition to mangano-manganic oxide.

1866: 5. TERREIL, A. Séparation du cobalt et du nickel, et séparation du manganèse, du nickel et du cobalt.

Bull. soc. chim. (2), **5**, 88; Dingl. pol. J., **180**, 305; Chem. Centrbl., **1866**, 149; Jsb. Chem., **1866**, 806; C. R., **62**, 139; L'Inst., **1866**, 28; Ztschr. Chem., **9**, 211; Ztschr. anal. Chem., **5**, 113; J. prakt. Chem., **100**, 52; Chem. News, **13**, 133.

Separation from cobalt and nickel by means of potassium permanganate or chlorine, in ammoniacal solution.

1867: 1. BRAUN, C. D. Zur Bestimmung des wirksamen Sauerstoffs in einigen Sauerstoffsäuren und Metalloxyden, eine Methode von vielfacher Anwendbarkeit.

Ztschr. anal. Chem., **6**, 66 and 73; Jsb. Chem., **1867**, 845; Chem. Centrbl., **1867**, 396; Ztschr. Chem., **1867**, 541; Chem.-techn. Rep., **6**, b, 96.

Detection by fusion with sodium pyrophosphate, or by heating the solution to be tested with phosphoric acid in the presence of lead peroxide. Determination by passing the chlorine evolved from the action of hydrochloric acid into a ferrous salt solution, and titration for the unoxidized iron.

1867: 2. FORBES, D. Analysis of Blister Steel.

Chem. News, **16**, 105; Chem. Centrbl., **1869**, 37.

Separation from iron by means of barium carbonate, precipitation by means of ammonium sulphide, solution of the precipitate in sulphuric acid, re-precipitation as carbonate, and ignition to mangano-manganic oxide.

1867: 3. GIBBS, W. On the Estimation of Manganese as Pyrophosphate.

Am. J. Sci. (2), **44**, 216; Jsb. Chem., **1867**, 845; Ztschr. Chem., **1867**, 721; J. prakt. Chem., **103**, 395; Ztschr. anal. Chem., **7**, 101; Bull. soc. chim. (2), **9**, 201; Chem. News, **17**, 195.

See title.

1867: 4. TOSH, E. G. On the Analysis of Cast Iron.

Chem. News, **16**, 168.

Separation from iron by the acetate method, precipitation as sulphide, re-precipitation as the carbonate, and ignition to manganomanganic oxide.

1868: 1. BRAUN, C. D. Ueber das Verhalten der Manganoxydulsalze zu den Natronsalzen der Phosphorsäure bei Anwesenheit wirksamen Sauerstoffs.

Ztschr. anal. Chem., **7**, 340; Jsb. Chem., **1868**, 227; Ztschr. Chem., **1869**, 306.

Detection by heating with phosphoric acid and lead peroxide. See also 1867: 1.

1868: 2. JUETTE. Sur une méthode de dosage de l'acide tartarique et de l'acide malique, au moyen du fer, de l'aluminium, du manganèse, etc., et réciproquement.

C. R., **66**, 417; Chem. News, **18**, 63; Bull. soc. chim. (2), **10**, 28.

Volumetric estimation by titration with tartaric or malic acid in alkaline solution.

1868: 3. LUNGE, G. Ueber die analytischen Arbeiten in Sodafabriken.

Dingl. pol. J., **186**, 205; Chem. Centrbl., **1868**, 1071.

Determination of the peroxide by passing the chlorine evolved under the action of hydrochloric acid, into a ferrous salt solution, and titration for the unoxidized iron.

1868: 4. TERREIL, A. Action des solutions salines sur les minéraux.

C. R., **66**, 668; Ztschr. Chem., **11**, 337; Chem. News, **13**, 45.

Separation from magnesium and zinc by means of ammonium sulphide in the presence of a large amount of ammonium salts.

1869: 1. CLASSEN, A. Ueber die Fällung und Bestimmung des Mangans durch Anwendung von Schwefelammonium.

Ztschr. anal. Chem., **8**, 370; Chem. Centrbl., **1870**, 530; Jsb. Chem., **1869**, 887; Ztschr. Chem., **1870**, 285; Bull. soc. chim. (2), **14**, 44; Chem.-techn. Rep., **9**, b, 122.

Some conditions under which precipitation as sulphide is incomplete.

1869: 2. DAMOUR, A. Notice sur la Jakobsite: nouvelle espèce minérale.

C. R., **69**, 168; Jsb. Chem., **1869**, 891; L'Inst., **1869**, 243.

Separation from iron by the acetate method and from magnesium by means of hydrogen peroxide.

1869: 3. GALETTI, M. Abänderung der Methoden zur volumetrischen Bestimmung des in Erzen enthaltenen Kupfers und Zinks mit einer Normallösung von Ferrocyankalium.

Ztschr. anal. Chem., **8**, 137.

Separation from zinc in alkaline solution by means of bromine.

1869: 4. How. On the Non-Precipitation of Manganese by Sulphide of Ammonium in Presence of some Organic Ammoniacal Salts.

Chem. News, **19**, 137; Jsb. Chem., **1869**, 887; Bull. soc. chim. (2), **13**, 48; Ztschr. Chem., **1869**, 414; Ztschr. anal. Chem., **9**, 382.

Influence of oxalic, tartaric, and citric acids on the precipitation as sulphide.

1869: 5. Luckow, C. Bestimmung des Kupfers in Mansfelder Schiefern.

Ztschr. anal. Chem., **8**, 24.

Electrolytic separation from copper.

1869: 6. Mohr, F. Zur Braunsteinanalyse.

Ztschr. anal. Chem., **8**, 314; Chem. News, **22**, 236.

Determination of manganese peroxide in pyrolusite. Comments on the Fresenius and Will method. See 1843: 3.

1869: 7. Muck. Ueber die Fällbarkeit des Kobalts durch Schwefelwasserstoff und Reinigung kobalthaltiger Mangansalze.

Ztschr. Chem., **12**, 626; Bull. soc. chim. (2), **13**, 334.

Precipitation of cobalt from a solution containing manganous carbonate by means of hydrogen sulphide.

1869: 8. Prior, M. E. Ueber der Zusammensetzung der Mangancarbonate.

Ztschr. anal. Chem., **8**, 428; Jsb. Chem., **1869**, 886; Ztschr. Chem., **1870**, 274; Bull. soc. chim. (2), **14**, 194.

Determination by precipitation as carbonate. Determination of manganese peroxide by passing the chlorine evolved from the action of hydrochloric acid into a ferrous salt solution and titrating for the unoxidized iron.

1869: 9. Renard, A. De l'emploi du phosphate de soude pour l'élimination du manganèse dans l'analyse volumétrique des minerais de zinc.

Bull. soc. chim. (2), **11**, 473; Chem. Centrbl., **1870**, 224; Ztschr. anal. Chem., **8**, 460; Chem. News, **20**, 35; Ztschr. Chem., **1869**, 662.

Separation from zinc by means of phosphates in ammoniacal solution.

1869: 10. Sherer, E., and Rumpf, G. On the Estimation of Peroxide of Manganese in Manganese Ores.

Chem. News, **20**, 302; **21**, 48; Jsb. Chem., **1869**, 889; Ztschr. Chem., **1870**, 478.

Comparison of the method of Fresenius and Will with the Bunsen method; also discussion of the iron method, and passage of chlorine into milk of lime and titration with arsenious acid.

1869: 11. TESCHENMACHER, E. F., and SMITH, J. D. Zur Braunsteinprüfung.

Ztschr. anal. Chem., **8**, 509; Ztschr. Chem., **13**, 287; Jsb. Chem., **1869**, 888.

Comparison of the results obtained by the method of Fresenius and Will and by the iron method.

1870: 1. FRESENIUS, R. Zur Analyse von Körpern welche beim Erhitzen mit Salzsäure Chlor entwickeln.

Ztschr. anal. Chem., **9**, 63; Jsb. Chem., **1870**, 993; Ztschr. Chem. **1870**, 479.

Criticisms of Bunsen's method for the determination of peroxide in pyrolusite.

1870: 2. GIBBS, W. On the Precipitation of Copper and Nickel by Alkaline Carbonates.

Am. J. Sci. (2), **44**, 213; Chem. Centrbl., **1870**, 62.

Precipitation of manganese by means of oxalic acid in presence of alcohol.

1870: 3. LEISON, W. G. On the Precipitation and Determination of the Metals of the Magnesium Group in the Form of Oxalates.

Am. J. Sci. (2), **50**, 240; Chem. News, **22**, 210; Chem. Centrbl., **1870**, 706.

Precipitation as oxalate. Comments on Gibbs's method. See 1870:2.

1870: 4. PARKER, J. S. On the Estimation of Manganese in Spiegeleisen.

Chem. News, **22**, 186; Dingl. pol. J., **199**, 49; Chem. Centrbl. **1870**, 725; Berg.- u. hüttenm. Ztg., **30**, 55; Wagner's Jsb., **17**, 13.

Influence of copper on the precipitation of manganese as hydrated peroxide.

1870: 5. PATTINSON, J. On the Estimation of Peroxide of Manganese in Manganese Ores.

Chem. News, **21**, 267; Am. Chemist, **1870**, 141; Ztschr. anal. Chem., **9**, 509; Chem. Centrbl., **1870**, 636; Jsb. Chem., **1870**, 991; Bull. soc. chim. (2), **14**, 347; Pol. Centrbl., **1871**, 117 and 1568; Berg- u. hüttenm. Ztg., **29**, 347; Ztschr. Chem., **1870**, 442; Chem.-techn. Rep. **10** a, 146; Dingl. pol. J., **197**, 422; Wagner's Jsb., **16**, 183.

Refers to Fresenius and Will's, Sherer and Rumpf's, and Bunsen's methods.

1870: 6. PAUL, B. H. On the Testing of Manganese Ores.

Chem. News, **21**, 16; Ztschr. anal. Chem., **9**, 410.

Solution of the ore in oxalic acid and titration for the excess with potassium permanganate.

1870: 7. POLLACCI, E. Présence du manganèse dans le lait et dans le sang.

J. de pharm. (4), **11**, 375; Chem. News, **21**, 274; Quart. J. Sci., **7**, 530.
Qualitative test for manganese in milk and blood by means of lead peroxide in nitric acid solution of the ash.

1870: 8. ROWAN, T. On the Estimation of Manganese in Spiegeleisen and Ferro-manganese.

Eng., **9**, 455; Dingl. pol. J., **197**, 330; Chem. Centrbl., **1870**, 592; Jsb. Chem., **1870**, 993; Chem.-techn. Rep., **9**, b, 126; Wagner's Jsb., **16**, 13; Berg- u. hüttenm. Ztg., **29**, 347.
Separation from iron by the acetate method, precipitation by chlorine, and re-precipitation as carbonate.

1870: 9. SHERER, E. Assay of Manganese Ores.

Chem. News, **21**, 284; Ztschr. anal. Chem., **9**, 513; Am. Chemist, **1**, 144; Berg- u. hüttenm. Ztg., **30**, 312.
Comments on Pattinson article. See 1870 : 5.

1870: 10. SHERER, E., and RUMPF, G. Ueber die verschiedenen Methoden der Braunsteinprüfung.

Ztschr. anal. Chem., **9**, 46; Jsb. Chem., **1869**, 889; Ztschr. Chem. **1870**, 478; Chem. News, **22**, 227; N. Jahrb. Pharm., **34**, 211; Pol. Centrbl., **1870**, 46.
See 1869 : 10.

1870: 11. TALBOTT, J. H. A New Analytical Process.

Am. J. Sci. (2), **50**, 244; Chem. Centrbl., **1870**, 707; Jsb. Chem., **1871**, 928; Chem.-techn. Rep., **10**, a, 147; Ber., **4**, 279.
Precipitation as sulphide and re-precipitation as phosphate.

1870: 12. TISSANDIER, G. Méthodes d'analyse et composition des produits chimiques industrielles.

Monit. scientif., **12**, 277.
Valuation of "manganese" of commerce. Formation of hypochlorite from chlorine evolved, and titration with arsenious acid.

1871: 1. ALLEN, A. H. On the Employment of Potassium Ferricyanide as a Test for Cobalt, Nickel, and Manganese.

Chem. News, **23**, 290; Jsb. Chem., **1871**, 930; Bull. soc. chim. (2), **16**, 93; J. Chem. Soc. (Lond.), **24**, 757; Ztschr. anal. Chem., **11**, 79; Ztschr. Chem., **1871**, 413.
Detection by means of potassium ferricyanide.

1871: 2. CHATARD, T. M. Contribution to Chemistry from the Laboratory of the Lawrence Scientific School.

Am. J. Sci. (3), **1**, 419; Jsb. Chem., **1871**, 928; Chem. Centrbl., **1871**, 426; Chem. News, **24**, 196; Ztschr. anal. Chem., **11**, 308; J. Chem. Soc. (Lond.), **26**, 531.
Quantitative application of Crum's test. Ammonium oxalate employed to titrate for the permanganic acid. See 1845 : 2.

1871: 3. KÄMMERER, H. Ueber die Anwendung des Broms statt des Chlors zu analytischen Zwecken.

Ber., **4**, 218; Jsb. Chem., **1871**, 866; Ztschr. Chem., **1871**, 444; Ztschr. anal. Chem., **10**, 464.
Recommends use of bromine for manganese precipitations.

1871: 4. LUCK, E. Beiträge zur Braunsteinanalyse nach den Fresenius- Will'schen Verfahren.

Ztschr. anal. Chem., **10**, 310; Jsb. Chem., **1871**, 929; J. Chem. Soc. (Lond.), **25**, 264; Dingl. pol. J., **202**, 305; Pol. Centrbl., 1871, 1568.
Determination of the accuracy of the method.

1871: 5. ROWAN, T. On the Estimation of Manganese in Spiegeleisen and Ferro-manganese.

Chem. News, **23**, 279; J. Chem. Soc. (Lond.), **24**, 756; Am. Chemist, **2**, 75.
Precipitation of manganese as carbonate.

1871: 6. TAMM, H. On a New Method of Estimating Zinc.

Chem. News, **24**, 150; Jsb. Chem., **1871**, 932; Ztschr. Chem., **14**, 467; Bull. soc. chim. (2), **16**, 261.
Determination of manganese as phosphate.

1872: 1. ALLEN, A. H. Estimation of Manganese.

Chem. News, **26**, 81.
Comments on Tamm's article. See 1871: 6.

1872: 2. BÖTTGER, R. Nachweisung von Spuren von Mangan.

*Jsb. phys. Ver. Frankfurt, **10**, 388; Vierteljsb. prakt. Pharm., **21**, 418; Jsb. Chem., **1872**, 911; Ztschr. anal. Chem., **1872**, 433; Chem. News, **24**, 192; Chem.-techn. Rep., **10**, b. 150; J. Frank. Inst., **93**, 87.
Detection of small amounts of manganese by contact of substance with fused potassium chlorate.

1872: 3. FRESENIUS, R. Ueber die Bestimmung des Mangans auf gewichtsanalytischem Wege.

Ztschr. anal. Chem., **11**, 290 and 413; Jsb. Chem., **1872**, 908; Am. Chemist, **3**, 472; J. Chem. Soc. (Lond.), **26**, 409.
Determination as protosesquioxide after precipitation as manganous carbonate, hydroxide, hydrated peroxide (Guyard), or oxalate; as pyrophosphate (Gibbs) or as sulphide (Fresenius, Classen).

1872: 4. HORNER. The Spectra of Manganese in Blowpipe Beads.

Chem. News, **25**, 139; J. Chem. Soc. (Lond.), **25**, 524.
Detection by means of absorption spectra of blowpipe beads.

1872: 5. KESSLER, F. Beiträge zur Analyse des Roheisens und Stahls.

Ztschr. anal. Chem., **11**, 255; Monit. scientif., **15**, 826; Chem. News, **28**, 158.

Separation from iron by acetate and sulphate methods. Precipitation of manganese by bromine, solution in antimonious chloride, and titration with potassium permanganate.

1872: 6. KESSLER, F. Ueber die Bestimmung des Mangans in Roheisen, Stahl, und Stabeisen.

Ber., **5**, 605; Oester. Ztschr. Berg- u. Hüttenw., **20**, 405; Dingl. pol. J., **205**, 332 and 439; Pol. Centrbl., **1872**, 1608; Technologiste, Dec. **1872**; Chem. Centrbl., **1872**, 617; Chem. News, **27**, 14; J. Chem. Soc. (Lond.), **25**, 925; Chem.-techn. Rep., **11**, b, 199; Wagner's Jsb., **19**, 11; Am. Chemist, **4**, 76; Iron, **2**, 326.

See 1872: 5.

1872: 7. LECLERC, A. Dosage du manganèse dans les sols et dans les végétaux.

C. R., **75**, 1209; Chem. News, **26**, 296; Jsb. Chem., **1872**, 910; Chem. Centrbl., **1872**, 88; Bull. soc. chim. (2), **19**, 177; Ztschr. anal. Chem., **12**, 308; Dingl. pol. J., **206**, 366; J. Chem. Soc. (Lond.), **26**, 193; Chem.-techn. Rep., **12**, a, 193; Am. Chemist (1875), **5**, 267; Arch. Pharm., **202**, 268.

Oxidation to permanganic acid by means of lead peroxide, or red lead, and titration with mercurous nitrate.

1872: 8. PICHARD. Dosage du manganèse dans les minerais de fer, les fontes, les aciers, par un procédé colorimetrique.

C. R., **75**, 1821; Dingl. pol. J., **207**, 136; Jsb. Chem., **1872**, 909; Chem. News, **27**, 85; Bull. soc. chim. (2), **19**, 253; Ztschr. anal. Chem., **12**, 308; J. Chem. Soc. (Lond.), **26**, 407; Chem.-techn. Rep., **12**, a, 195; Berg- u. hüttenm. Ztg., **32**, 91.

Oxidation to permanganic acid by means of lead peroxide in nitric acid solution.

1872: 9. DE REZENDE. Note sur un procédé de séparation du fer et du manganèse.

Ann. des Mines (7), **1**, 418.

Separation from iron by means of cupric oxide.

1872: 10. TAMM, H. On an Improved Mode of Estimating Manganese.

Chem. News, **26**, 37; Am. Chemist, **3**, 145; Jsb. Chem., **1872**, 910; Monit. scientif., **14**, 973; Bull. soc. chim. (2), **19**, 121.

Precipitation with ammonium carbonate from solutions containing ammonium chloride. Separation from iron by the succinate method, and from zinc and nickel by ammonium carbonate.

1872: 11. TAMM, H. On the Metallurgy of Manganese, and the Docimastic Assaying of Manganese Ores.

Chem. News, **26**, 111; Am. Chemist, **3**, 177; Pol. Centrbl., **1872**, 1348.

Dry assay with various fluxes.

1873: 1. BRÜNNER, A. Schnell durchführbare colorimetrische Probe auf Mangangehalt des Roheisens, Stahls, Eisens, und Erze.

Oester. Ztschr. Berg- u. Hüttenw., **21**, 341; Chem. Centrbl., **1873**, 757; Bull. soc. chim. (2), **21**, 278; J. Chem. Soc. (Lond.), **27**, 604 and 816; Chem.-techn. Rep., **12**, b, 196; Wagner's Jsb., **20**, 10; Pol. Centrbl., **1873**, 1367; Dingl. pol. J., **210**, 278.

Conversion to sodium manganate and comparison of solutions.

1873: 2. GIBBS, W. On the Estimation of Manganese as Pyrophosphate.

Chem. News, **28**, 51; Jsb. Chem., **1873**, 934; J. Chem. Soc. (Lond.), **27**, 92.

Precipitation by means of salt of phosphorus. See 1867: 3.

1874: 1. KOPPMAYER, M. Ueber A. Brünner's colorimetrische Probe auf Mangangehalt des Stahls, Eisens, und der Erze.

Dingl. pol. J., **211**, 133; Jsb. Chem., **1874**, 988; Chem. Centrbl., **1874**, 138; J. Chem. Soc. (Lond.), **27**, 1009; Pol. Centrbl., **1874**, 395; Berg- u. hüttenm., Ztg., **33**, 109.

Regards Brünner's method as valueless. See 1873: 1.

1874: 2. MORRELL, T. T. Estimation of Manganese.

Am. Chemist, **5**, 213; Jsb. Chem. **1874**, 988.

Colorimetric method depending upon the liberation of iodine in solution, after precipitation by bromine.

1874: 3. PIESSE, C. H. The Estimation of Silicon, Graphite, Manganese, Aluminium, and Calcium in Pig Irons.

Chem. News, **29**, 110; Jsb. Chem., **1874**, 986; Bull. soc. chim. (2), **22**, 67; J. Chem. Soc. (Lond.), **27**, 711.

Separation from iron by the basic acetate method and precipitation by bromine.

1874: 4. PARRY, J. Estimation of Manganese in Spiegeleisen.

Chem. News, **29**, 86; Jsb. Chem., **1874**, 987; Am. Chemist, **4**, 434; J. Chem. Soc. (Lond.), **27**, 712; Bull. soc. chim. (2), **22**, 68.

Adaptation of Fresenius-Will method, after solution in nitric acid and ignition of the residue left on evaporation.

1874: 5. POUCHET, A. G. Revue des méthodes d'analyse des produits industriels: Titrage et assai des manganèses.

Monit. scientif., **16**, 1139.

Comments of Mohr (1855: 1), Fresenius-Will (1843: 3), and Bunsen (1853: 1) methods for the determination of peroxide; also of method involving oxidation of sulphurous acid by chlorine evolved, and precipitation of barium sulphate. Outlines of

methods for the determination of total acid consumed, and of manganese in "Weldon Mud."

1874: 6. WILLIS, A. Estimation of Manganese in Spiegeleisen.

Chem. News, **29**, 150; Jsb. Chem., **1874**, 987.
Comments on Piesse, 1874: 3.

1875: 1. BOUSSINGAULT. Études sur la transformation du fer en acier par la cémentation.

Ann. chim. phys. (5), **5**, 184; Dingl. pol. J., **224**, 80; Jsb. Chem., **1877**, 1061; Chem. Centrbl., **1877**, 376.
Separation from iron by basic acetate method, and precipitation by hypochlorite. Determination of small quantities by means of lead peroxide and titration with mercurous nitrate; also electrolytic deposition.

1875: 1a. BOLTON, H. C. Index to the Literature of Manganese, 1596–1874.

* Annals Lyceum Nat. Hist. N. Y., Nov., **1875**.
Compilation of journal literature on manganese and its compounds.

1875: 2. KERN, S. Estimation of Manganese in Spiegeleisen, Iron, and Steel.

Chem. News, **32**, 100; Jsb. Chem., **1875**, 955; Ztschr. anal. Chem., **16**, 505; J. Chem. Soc. (Lond.), **29**, 110; Chem.-techn. Rep., **14**, a, 278; Wagner's Jsb., **22**, 19; Am. Chemist, **6**, 192.
Precipitation as manganous hydroxide, reduction in hydrogen, separation of iron by magnet, and ignition to protosesquioxide.

1875: 3. LUNGE, G. Ueber die neusten Fortschritte in der Soda- und Chlorkalk-Industrie in England.

Dingl. pol. J., **215**, 157; Pol. Centrbl., **1875**, 853.
Determination in "Weldon Mud" by ferrous sulphate and permanganate.

1875: 4. MORRELL, T. T. Note on the Estimation of Manganese in Spiegeleisen.

Am. Chemist, **6**, 45; Jsb. Chem., **1875**, 954.
Separation from iron by the basic acetate method, precipitation by bromine, and colorimetric determination by the liberation of iodine. (See 1874: 2.)

1875: 5. VOGEL, H. W. Ueber die Absorptionsspectren einiger Salze der Metalle der Eisengruppe und Anwendung in der Analyse.

Ber., **8**, 1533; Dingl. pol. J., **219**, 533.
Detection by means of absorption spectra of permanganic acid.

1876: 1. CAMPANI, G. Il manganese nille ceneri si manifesta facilmente sotto la forma di fosfato manganico.

Gazz. chim. ital., **1876,** 464; Jsb. Chem., **1876,** 1000; Chem. News, **35,** 75; J. Chem. Soc. (Lond.), **32,** 223.

Detection in plant ashes by the color of the residue after evaporation with nitric acid.

1876: 2. FRESENIUS, R. Methode zur Analyse alkalischer Mineralwasser.

Ztschr. anal. Chem., **15,** 222 and 225.

Determination in mineral water by precipitation as sulphide and ignition in hydrogen.

1876: 3. GALBRAITH, W. The Determination of Manganese in Spiegeleisen.

Chem. News, **33,** 47; Am. Chemist, **6,** 462; Oester. Ztschr. Berg- u. Hüttenw., **25,** 31; Jsb. Chem., **1876,** 999; Dingl. pol. J., **221,** 448; Ztschr. anal. Chem., **16,** 506; J. Chem. Soc. (Lond.), **28,** 750; Wagner's Jsb., **22,** 18; Berg- u. hüttenm. Ztg., **35,** 355; Chem.-techn. Rep., **15,** 479.

Solution in nitric acid, evaporation and ignition; solution of residue with ferrous ammonium sulphate and titration for the excess.

1876: 4. KERN, S. Estimation of Manganese in Cast Iron.

Chem. News, **33,** 90; J. Chem. Soc. (Lond.), **29,** 962; Dingl. pol. J., **221,** 188; Am. Chemist, **7,** 76; Rev. univers. des Mines, **39,** 199; Bull. soc. chim. (2), **26,** 474.

Precipitation of iron and manganese by potassium hydroxide, solution of manganese by addition of ammonium chloride, filtration, precipitation as sulphide, strong heating with sulphuric acid, and weighing as mangano-manganic oxide.

1876: 5. PETERS, S. On the Estimation of Manganese in Iron and Steel.

Chem. News, **33,** 35; Jsb. Chem., **1876,** 999; Dingl. pol. J., **221,** 486; J. Chem. Soc. (Lond.), **29,** 750; Wagner's Jsb., **22,** 19; Chem.-techn. Rep., **15,** 480.

Colorimetric method. Oxidation to permanganic acid by lead peroxide.

1876: 6. PHIPSON, T. L. Determination of Manganic Oxide.

Chem. News, **34,** 19 and 39.

Determination of manganese peroxide in the presence of sesquioxide.

1877: 1. BOLTON, H. C. Schemes of Analysis Executed in the School of Mines, Columbia College.

Am. Chemist, **7,** 307.

Determination as pyrophosphate (Gibbs' method, 1867: 3).

1877: 2. CHAPMAN, E. J. On Some Blow-pipe Reactions.

Chem. News, **35,** 13 and 26; J. Chem. Soc. (Lond.), **31,** 489.

Detection by means of sodium carbonate.

77: 3. CLASSEN, A. Quantitative Bestimmung des Mangans durch Fällung als Manganoxalat.

Ztschr. anal. Chem., **16**, 315; J. Chem. Soc. (Lond.), **32**, 804; Dingl. pol. J., **225**, 515; Chem. Centrbl., **1877**, 503; Chem.-techn. Rep., **16**, 636.

Precipitation as oxalate and weighing as protosesquioxide.

77: 4. CLASSEN, A. Zur Trennung des Mangans von Kalk.

Ztschr. anal. Chem., **16**, 318; Jsb. Chem., **1877**, 1055; Chem. Centrbl., **1877**, 470; J. Chem. Soc. (Lond.), **32**, 805; Dingl. pol. J., **225**, 515; Chem.-techn. Rep., **16**, 636.

Separation by means of oxalic acid not practicable.

77: 5. CLASSEN, A. Ueber die Abscheidung des Mangans als wasserfreies Sulfür.

Ztschr. anal. Chem., **16**, 319; Jsb. Chem., **1877**, 1062; Chem. Centrbl., **1877**, 470; J. Chem. Soc. (Lond.), **32**, 514.

Precipitation as sulphide in presence of potassium oxalate.

77: 6. CLASSEN, A. Ueber eine neue Methode zur Trennung des Eisens von Mangan, Kobalt, Nickel und Zink.

Ber., **10**, 1316; Jsb. Chem., **1877**, 1064 and 1066; Chem. Centrbl., **1877**, 602; Ztschr. anal. Chem., **16**, 471; Bull. soc. chim. (2), **30**, 409.

Separation from iron by means of neutral potassium oxalate and acetic acid.

77: 7. CLASSEN, A. Quantitative Bestimmung von Mangan, Kobalt, Nickel und Zink durch Fällung als Oxalate.

Ber., **10**, 1315; J. Chem. Soc. (Lond.), **32**, 924.

See 1877: 3.

77: 8. DEBY. Determination of Manganese in Spiegel, Iron, and Steel at Terrenoire.

* Report, **1877**, II; Berg- u. hüttenm. Ztg., **37**, 391.

Oxidation to permanganic acid by lead peroxide and titration with arsenious acid.

77: 9. FUNARO, A. Della seperazione quantitativa del ferro e del manganese nei minerali ferro-manganici.

Gazz. chim. ital., **7**, 286; Jsb. Chem., **1877**, 1064; Chem. Centrbl., **1877**, 661; Ber., **10**, 1383; J. Chem. Soc. (Lond.), **32**, 805; Dingl. pol. J., **225**, 610; Chem.-techn. Rep., **16**, 635.

Separation from iron by means of ammonium benzoate or succinate.

77: 10. HANNAY, J. B. Note on a New Manganese Reaction.

J. Chem. Soc. (Lond.), **33**, 269; Jsb. Chem., **1877**, 1063; Chem. Centrbl., **1878**, 41; Chem. News, **36**, 212; Bull. soc. chim. (2), **30**, 412; Ber., **10**, 2052; Chem.-techn. Rep. **16**, 637.

Precipitation by potassium chlorate in nitric acid solution, and determination by gravimetric and volumetric methods.

1877: 11. KERN, S. Quantitative Analysis of Certain Metals in Iron and Steel.

Chem. News, **35**, 67; Jsb. Chem., **1877**, 1057; J. Chem. Soc. (Lond.), **32**, 647; Eng. Min. J., **24**, 127.

Determination in chrome-iron alloys. Use of sodium hypochlorite for precipitation advised.

1877: 12. KERN, S. On the Estimation of Manganese in Spiegeleisen and Ferro-manganese.

Chem. News, **35**, 247 and 270; Ber., **10**, 975; Jsb. Chem., **1877**, 1062; Chem. Centrbl., **1877**, 457; Dingl. pol. J., **225**, 392; Chem. -techn. Rep., **16**, 635.

Determination in alloys by ignition of mixed oxides of iron and manganese in hydrogen, and then in chlorine, leaving a residue of protosesquioxide. Also direct ignition of the alloy with ammonium chloride.

1877: 13. KRÄMER, C. Zur Trennung des Mangans von Eisen.

Ztschr. anal. Chem., **16**, 334; Jsb. Chem., **1877**, 1063; J. Chem. Soc. (Lond.), **32**, 805.

Separation from iron by the basic acetate method. See Stöckmann, 1877: 20.

1877: 14. MUNROE, C. E. The Estimation of Manganese as Pyrophosphate.

Am. Chemist, **7**, 287; Jsb. Chem., **1877**, 1061; Iron, **9**, 555.

The influence of ammonia upon the determination as phosphate.

1877: 15. PARREÑO, A. G. Determination du manganèse métallique par la voie volumétrique.

Ann. chim. phys. (5), **11**, 571; Jsb. Chem., **1877**, 1062; Chem. Centrbl., **1877**, 615; Am. J. Sci. (3), **14**, 418; J. Chem. Soc. (Lond.), **32**, 924; Pharm. Centrh., **18**, 396; Chem.-techn. Rep., **16**, 636.

Ignition of mineral to mangano-manganic oxide, treatment with hydrochloric acid and determination of the iodine liberated from potassium iodide, by the chlorine evolved.

1877: 16. PERREY. (Title unknown.)

* Bull. de Rouen, **1877**, 104; Jsb. Chem., **1877**, 1063; Chem. Centrbl., **1878**, 15; Dingl. pol. J., **226**, 194; Chem.-techn. Rep., **16**, 640.

Comparison of Fresenius-Will (1843: 3), Hempel (1858: 1), Gay-Lussac (1829: 1), Mohr (1855: 1), and Bunsen (1853: 1) methods for analysis of pyrolusite.

877: 17. RICHE, M. A. Note sur la dosage du manganèse, du nickel, du zinc et du plomb.

C. R., **85**, 226; Jsb. Chem., **1877**, 1066; Chem. News, **36**, 96; Ztschr. anal. Chem., **17**, 216; Bull. soc. chim. (2), **29**, 378; Dingl. pol. J., **239**, 380; J. Chem. Soc. (Lond.), **32**, 924; Eng. Min. J., **24**, 222; Chem.-techn. Rep., **16**, 637; Rev. univers. des mines, **2**, 297; Chem. Ind., **7**, 27.

Electrolytic determination.

877: 18. RILEY, E. On the Estimation of Manganese in Spiegeleisen and Iron in Manganiferous Ores.

J. Iron Steel Inst., **1877**, a, 52; Chem. News, **35**, 175; J. Chem. Soc. (Lond.), **32**, 1; Chem. Centrbl., **1877**, 376; Oester. Ztschr. Berg- u. Hüttenw., **25**, 424; Dingl. pol. J., **227**, 493; Iron, **9**, 617, 711, and 746; Jsb. Chem., **1877**, 1061; Ber., **10**, 911; Bull. soc. chim. (2), **29**, 282; Berg- u. hüttenm. Ztg., **36**, 223; Wagner's Jsb., **23**, 21; Chem.-techn. Rep., **16**, 633.

Separation from iron by the acetate method, precipitation by bromine, and ignition; also determination by difference.

877: 19. ROSENTHAL, G. Ueber die Fällung des Mangans mit Wasserstoffsuperoxyd.

Dingl. pol. J., **225**, 154; Jsb. Chem., **1877**, 1037; Chem. Centrbl., **1877**, 651; Chem. News, **36**, 147; Ztschr. anal. Chem., **17**, 364; J. Chem. Soc. (Lond.), **32**, 923; Bull. soc. chim. (2), **32**, 364; Berg- u. hüttenm. Ztg., **36**, 324; Chem.-techn. Rep., **16**, 635.

Separation from iron by the acetate method, and precipitation by means of hydrogen peroxide.

877: 20. STÖCKMANN, C. Ueber die Bestimmung von Mangan und Phosphor im Spiegeleisen.

Ztschr. anal. Chem., **16**, 172; Jsb. Chem., **1877**, 1063; Dingl. pol. J., **225**, 108; J. Chem. Soc. (Lond.), **32**, 648; Chem. News, **36**, 275; Monit. scientif., **19**, 1274.

Separation from iron by the acetate method. See 1877: 13.

878: 1. BONG, G. Sur un bleu au manganèse.

Bull. soc. chim. (2), **29**, 199; Jsb. Chem., **1878**, 1129.

Detection with the aid of a flux of silica, metallic sodium, and calcium carbonate.

878: 2. DESHAYES, V. Dosage du manganèse dans les fers, fontes et aciers; dans les spiegels, ferro-manganèses et minerais.

Bull. soc. chim. (2), **29**, 541; Jsb. Chem., **1878**, 1062; Chem. News, **38**, 70; J. Chem. Soc. (Lond.), **34**, 808; Bull. soc. ind. minerale (2), **7**, 163.

Oxidation to permanganic acid by lead peroxide, and titration with arsenious acid.

878: 3. MATZURKE, G. Zur Trennung von Eisen und Mangan.

Ztschr. anal. Chem., **17**, 78; Jsb. Chem., **1878**, 1061.

Separation from iron by acetate method. See Krämer, 1877: 13.

1878: 4. MORAWSKI, T., and STINGL, J. Ueber eine maassanalytische Bestimmung des Mangans.

J. prakt. Chem. (2), **18**, 96; Jsb. Chem., **1878**, 275; Chem. Centrbl., **1878**, 758; Chem. News, **38**, 297; J. Chem. Soc. (Lond.), **36**, 277; Ztschr. anal. Chem., **18**, 471; Ber., **11**, 1933; Bull. soc. chim. (2), **32**, 603; Chem.-techn. Rep., **17**, b, 241.

Determination by potassium permanganate in slightly acid solution.

1878: 5. MORAWSKI, T., and STINGL, J. Zur Bunsen'schen Braunsteinbestimmungsmethode.

J. prakt. Chem. (2), **18**, 101; Chem. Centrbl., **1878**, 759; Jsb. Chem., **1878**, 275; Ztschr. anal. Chem., **18**, 471; Ber., **11**, 1933; J. Chem. Soc. (Lond.), **36**, 278.

Modification of an apparatus for the Bunsen method for the analysis of pyrolusite.

1878: 6. MÜLLER, F. C. G. Untersuchungen über den Bessemerprocess.

Ber., **11**, 552; Ztschr. Ver. d. Ing., **22**, 467.

Separation from iron by the acetate method and precipitation by chlorine.

1878: 7. PROCHASKA, J. Der Siemens-Martinprocess im Südbahnwalzwerke im Graz.

Oester. Ztschr. Berg- u. Huttenw., **26**, 116; Berg- u. hüttenm. Ztg., **37**, 147.

Oxidation to permanganate acid by red lead and titration by ferrous sulphate.

1878: 8. RICHE, A. Mémoire sur le dosage du manganèse, du plomb du cuivre, du zinc et du nickel; et sur l'analyse des alliages de ces métaux.

Ann. chim. phys. (5), **13**, 508; Berg- u. hüttenm. Ztg., **37**, 26; Jsb. Chem., **1878**, 1062; J. Chem. Soc. (Lond.), **34**, 750.

Electrolytic determination.

1878: 9. WRIGHT, C. R. A., and LUFF, A. P. Researches on Some Points in Chemical Dynamics.

J. Chem. Soc. (Lond.), **33**, 526.

A study of the oxides of manganese with reference to the bearing of the results reached upon current analytical methods.

1879: 1. BEILSTEIN, F., and JAWEIN, L. Ueber eine directe Trennung des Mangans von Eisen.

Ber., **12**, 1528; Iron, **14**, 587; Jsb. Chem., **1879**, 1045; Chem. News, **40**, 300; Ztschr. anal. Chem., **19**, 77; Chem. Ztg., **3**, 630; Bull. soc. chim. (2), **32**, 604; J. Chem. Soc. (Lond.), **38**, 61; Dingl. pol. J., **234**, 254; Wagner's Jsb., **26**, 320; Monit. scientif., **22**, 811;

J. Am. Chem. Soc., **1**, 533; Berg- u. hüttenm. Ztg., **38**, 360; Am. Chem. J., **2**, 73; Arch. Pharm., **215**, 449; J. Iron Steel Inst., **1880**, 354.

Separation from iron by iodine in cyanide solution; also by precipitation by potassium chlorate in nitric acid; precipitation as sulphide.

1879: 2. CARNOT, A. Sur l'emploi de l'hydrogène sulfuré par voie sèche dans les analyses.

Bull. soc. chim. (2), **32**, 161; C. R., **89**, 167; Jsb. Chem., **1879**, 1024.

Determination as sulphide, with use of Rose crucible. See 1860: 5.

1879: 3. CLASSEN, A. Zur Trennung des Mangans von Zink.

Ztschr. anal. Chem., **18**, 194; Chem. Centrbl., **1879**, 366; J. Chem. Soc. (Lond.), **36**, 1055; Chem. Ztg., **3**, 253; Chem. News, **40**, 33; J. Am. Chem. Soc., **1**, 327.

Criticism of Tamm procedure. See 1872: 10.

1879: 4. CLASSEN, A. Ueber eine neue quantitative analytische Methode von vielfacher Anwendbarkeit.

Ztschr. anal. Chem., **18**, 379, 380, and 396; Chem. News, **40**, 33; Chem. Ztg., **3**, 676; Bull. soc. chim. (2), **35**, 91; J. Chem. Soc. (Lond.), **36**, 969.

Separation from iron and aluminum with the aid of potassium oxalate.

1879: 5. CLASSEN, A. Ueber eine neue Methode zur Trennung des Eisenoxyds und der Thonerde von Mangan.

Ztschr. anal. Chem., **18**, 175; Chem. Centrbl., **1879**, 365; Jsb. Chem., **1879**, 1045; Bull. soc. chim. (2), **33**, 446; J. Chem. Soc. (Lond.), **36**, 1055; J. Am. Chem. Soc., **1**, 325.

See 1879: 4.

1879: 6. KESSLER, F. Ueber die Bestimmung des Mangans, besonders in Eisen-Manganlegirungen.

Ztschr. anal. Chem., **18**, 1; Iron, **13**, 643, 675, and 706; Jsb. Chem., **1879**, 1050; Chem. Centrbl., **1879**, 90; J. Chem. Soc. (Lond.), **36**, 341; Chem. Ztg., **3**, 30; J. Am. Chem. Soc., **1**, 83; Am. Chem. J., **1**, 363; J. Frank. Inst., **107**, 411; Dingl. pol. J., **232**, 91; J. Iron Steel Inst., **1880**, 353.

Separation from iron by means of sodium sulphate, precipitation by bromine, solution of the peroxide by antimonious chloride, and titration with potassium permanganate.

1879: 7. LEDEBUR, A. Zur chemischen Untersuchung des Eisens und seiner Erze.

Berg- u. hüttenm. Ztg., **38**, 47.

Comparison of Kessler (1879: 6), Riley (1877: 18), Müller (1851: 2), the sulphide and indirect methods of determination.

1879: 8. MACKINTOSH, J. B. (Correspondence.)

School Mines Quart., **1**, 127.
Separation from iron by the acetate method, and precipitation by bromine.

1879: 9. PATTINSON, J. On a New Volumetric Method of Determining Manganese in Manganiferous Iron Ores, Spiegeleisen, Steel, etc.

J. Iron Steel Inst., **1879**, a, 209; b, 335; Rev. univers. des mines, **10**, 135.
Precipitation by hypochlorite in the presence of ferric salts, solution by ferrous iron and titration of the excess.

1879: 10. PATTINSON, J. On a Method of Precipitating Manganese entirely as Dioxide and its Application to the Volumetric Determination of Manganese.

J. Chem. Soc. (Lond.), **35**, 365; Chem. News, **39**, 201; Jsb. Chem., **1879**, 1047; Monit. scientif., **22**, 465; Ztschr. anal. Chem., **19**, 346; Ber., **12**, 1025; J. Am. Chem. Soc., **1**, 327; Iron, **13**, 336; **14**, 12; Wagner's Jsb., **26**, 321; Dingl. pol. J., **234**, 160; J. Anal. Chem., **1**, 71.
See 1879: 9.

1879: 11. PICKERING, S. U. On the Reaction between Sodium Thiosulphate and Iodine: Estimation of Manganese Oxides and Potassium Bichromate.

J. Chem. Soc. (Lond.), **37**, 128; Chem. News, **40**, 261; Jsb. Chem., **1880**, 1182; Chem. Centrbl., **1880**, 103; Bull. soc. chim. (2), **36**, 261; Dingl. pol. J., **236**, 350.
Determination of peroxide in pyrolusite by the titration of iodine liberated by the chlorine evolved on solution in hydrochloric acid.

1879: 12. PELLITZ, W. Analyse des Zsadanyer Meteoriten.

Ztschr. anal. Chem., **18**, 64.
Determination in meteorites.

1879: 13. RÖSSLER, C. Ueber eine neue Bestimmung des Mangans mit Anwendung des Volhard'schen Silbertitrirverfahrens.

Ber., **12**, 925; Jsb. Chem., **1879**, 1050; Chem. Centrbl., **1879**, 427; J. Chem. Soc. (Lond.), **36**, 746; Chem. News, **40**, 169; Bull. soc. chim. (2), **33**, 281; Wagner's Jsb., **25**, 16; J. Am. Chem. Soc., **1**, 329; Dingl. pol. J., **233**, 86.
Precipitation with ammoniacal silver nitrate, filtration of the mangano-silver compound, and titration for the excess of the silver by the sulphocyanide procedure.

1879: 14. VOLHARD, J. Zur Scheidung und Bestimmung des Mangans.

Ann. Chem. (Liebig), **198**, 318; Jsb. Chem., **1879**, 1048; Chem. News, **40**, 207; J. Chem. Soc. (Lond.), **38**, 141; Ztschr. anal. Chem., **20**, 271 and 285; Ber., **12**, 2175; Bull. soc. chim. (2), **34**, 715; Berg- u. hüttenm. Ztg., **39**, 150; J. Iron Steel Inst., 1880, 355.

Volumetric determination by potassium permanganate; separation from iron and aluminum by mercuric or zinc oxide; precipitation by halogens or lead peroxide in neutral solution; determination as manganous sulphate and as mangano-manganic oxide.

1880: 1. BÖTTGER, R. Höchst empfindliche Reaction auf Mangan.

* Technische Blätter; * Tagebl. Natf. Ver. Baden-Baden, **1879**, 193; Chem. Centrbl., **1880**, 249; Jsb. Chem., **1880**, 1181; Oester. Ztschr. Berg- u. Hüttenw., **28**, 416.

See 1872: 2.

1880: 2. DELLFS, H. The Behaviour of Sulphuretted Hydrogen with the Salts of the Heavy Metals.

Chem. News, **41**, 279; Jsb. Chem., **1880**, 1144.

Precipitation by sulphuretted hydrogen in the presence of organic acids.

1880: 3. DROWN, T. M., and SHIMER, P. W. The Determination of Silicon and Titanium in Pig Iron and Steel.

Trans. Am. Inst. Min. Eng., **8**, 514.

Separation from iron by heating the iron or steel in an atmosphere of chlorine.

1880: 4. DUNSTON, W. R. The Analysis of Steel.

Pharm. J. Trans. (3), **10**, 594; Jsb. Chem., **1880**, 1180.

Separation from iron by the acetate method, precipitation by bromine, and ignition to mangano-manganic oxide.

1880: 5. HASWELL, A. E. Volhard's Titrirung des Mangans mit übermangansaures Kali.

Dingl. pol. J., **235**, 387; Jsb. Chem., **1880**, 1181; Chem. Centrbl., **1880**, 249; Chem. Ztg., **4**, 224; J. Iron Steel Inst., **1882**, 743.

Confirmation of Volhard's procedure. (1879: 14.)

1880: 6. JEWETT, J. Influence of Acetic Acid on the Separation of Iron as a Basic Acetate from Manganese, Zinc, Cobalt, and Nickel.

Chem. News, **40**, 273; J. Chem. Soc. (Lond.), **38**, 289.

See title.

1880: 7. V. JÜPTNER, H. Volhard's Methode der Trennung und Bestimmung des Mangans.

Oester. Ztschr. Berg- u. Hüttenw., **28**, 168.

Favorable comment upon the Volhard method. (1879: 14.)

1880: 8. JURISCH, K. Zur Prüfung des Weldonschlamms.

Chem. Ind., **1880,** 193; Dingl. pol. J., **237,** 312; Wagner's Jsb., **26,** 324.

Determination of peroxide in "Weldon Mud" and of total acid consumed on solution.

1880: 9. DE KONINCK, L. L. Bromlösung als Reagens.

Ztschr. anal. Chem., **19,** 468; Jsb. Chem., **1880,** 1153.

Merely refers to the use of bromine for precipitation.

1880: 10. LUCKOW, C. Ueber die Anwendung des elektrischen Stromes in der analytischen Chemie.

Ztschr. anal. Chem., **19,** 17; Chem. News, **41,** 213; Jsb. Chem., **1880,** 1140.

Electrolytic precipitation.

1880: 11. LUNGE, G. Ueber die Zusammensetzung und Analyse des nach Weldon's Verfahren regenerirten Mangansuperoxydes.

Dingl. pol. J., **235,** 300; **236,** 231 and 236; Chem. News, **41,** 141 and 181; Jsb. Chem., **1880,** 1183; J. Chem. Soc. (Lond.), **38,** 528.

Discussion as to the efficiency of the ferrous sulphate-permanganate method for the determination of manganese in "Weldon Mud." See 1880: 14 and 1881: 12.

1880: 12. PARRY, J., and TUCKER, A. E. The Application of the Spectroscope to the Analysis of Iron and Steel.

J. Iron Steel Inst., **1880,** a, 163.

Detection of manganese.

1880: 13. PATTINSON, J. (Discussion.)

Chem. News, **41,** 179; Jsb. Chem., **1880,** 1183.

Precipitation is incomplete by means of chloride of lime except in the presence of ferric chloride. See 1880: 16.

1880: 14. POST, J. Ueber die Zusammensetzung und Analyse des nach Weldon's Verfahren regenerirten Mangansuperoxydes.

Verh. Ver. Beförd. Gewerbfleiss., **58,** 464; Dingl. pol. J., **236,** 225 and 235; Wagner's Jsb., **26,** 317.

Criticism of method used by Lunge, 1880: 11. See also 1881: 12.

1880: 15. RÖSSLER, C. Ueber eine neue maassanalytische Bestimmungsmethode des Mangans und des Kobalts.

Ann. Chem. (Liebig), **200,** 323; Jsb. Chem., **1880,** 1182; Chem. Centrbl., **1880,** 250; Ztschr. anal. Chem., **19,** 75; Chem. News, **41,** 184; Chem. Ztg., **4,** 86; J. Chem. Soc. (Lond.), **38,** 347; Dingl. pol. J., **235,** 391.

Determination with the aid of silver and the Volhard silver titration. See 1879: 12.

1880: 16. WELDON. Volumetric Estimation of Manganese.

Chem. News, **41**, 207; Jsb. Chem., **1880**, 1183.
Precipitation by means of chloride of lime found to be complete. See 1880: 13.

1880: 17. WRIGHT, C. R. A., and MENKE, A. E. Note on Manganese Dioxide.

J. Chem. Soc. (Lond.), **37**, 22; Chem. News, **40**, 261; Jsb. Chem., **1880**, 316; Chem. Centrbl., **1880**, 66; Chem. Ztg., **4**, 86; Ber., **13**, 427.
Composition of manganese peroxide prepared in different ways.

1880: 18. WRIGHT, C. R. A., and MENKE, A. E. Volumetric Determination of Manganese.

J. Chem. Soc. (Lond.), **37**, 42.
Comment on Pattinson's method. See 1879: 9.

1880: 19. VELEY, V. H. On Some Higher Oxides of Manganese and their Hydrates.

Chem. News, **41**, 291; **44**, 241 and 301; J. Chem. Soc. (Lond.), **37**, 581.
A study of the various oxides of manganese.

1880: 20. ZIMMERMANN, C. Zur Scheidung der Schwermetalle der Schwefelammoniumgruppe.

Ann. Chem. (Liebig), **199**, 3 and 9; **200**, 226; Chem. Centrbl. **1880**, 40.
Separation from zinc with the use of ammonium sulphocyanate.

1881: 1. BEILSTEIN, F., and JAWEIN, L. Bestimmung und Trennung einiger Metalle. I. Directe Trennung des Mangans von Eisen.

* Ztschr. rusk. chim. obsc., **13**, 9; Chem. Centrbl., **1881**, 251; J. Chem. Soc. (Lond.), **42**, 97; Wagner's Jsb., **27**, 358.
Separation from iron by precipitation with iodine from cyanide solution, and also by potassium chlorate in nitric acid solution.

1881: 2. CLASSEN, A. Electrolytische Bestimmungen und Trennungen.

Ber., **14**, 2772; Dingl. pol. J., **242**, 440; Jsb. Chem., **1881**, 1151; Bull. soc. chim. (2), **37**, 525; J. Chem. Soc. (Lond.), **42**, 896; Wagner's Jsb., **28**, 448; Ztschr. anal. Chem., **22**, 417; School Mines Quart., **3**, 302.
Separation from iron, alumina, and phosphoric acid by electrolysis in the presence of oxalates.

1881: 3. CLASSEN, A., and v. REIS, M. Electrolytische Bestimmungen und Trennungen.

Ber., **14**, 1626 and 1630; Dingl. pol. J., **242**, 441; Jsb. Chem., **1881**, 1152; J. Chem. Soc. (Lond.), **40**, 1081; Ztschr. anal. Chem., **21**, 255; Bull. soc. chim. (2), **37**, 184; Wagner's Jsb., **27**, 356; Am. Chem. J., **4**, 58.

Electrolytic separation from iron, and determination by electrolysis.

1881: 4. DELVAUX, G. Séparation de l'oxyde de nickel et l'oxyde de cobalt.

C. R., **92**, 723; Jsb. Chem., **1881**, 1188; Ztschr. anal. Chem., **21**, 111.

Separation from cobalt by sulphuretted hydrogen in acetic acid solution, and from nickel by oxidation on standing in the air.

1881: 5. DESHAYES, V. Revue métallurgique.

Bull. soc. chim. (2), **36**, 121.

Comments on Ford's and colorimetric methods of determination in steels. See 1881 : 8.

1881: 6. DONATH, E. Ueber eine volumetrische Bestimmung von Chrom und Mangan neben Eisenoxyd und Thonerde.

Ber., **14**, 982; Chem. News, **43**, 253; Jsb. Chem., **1881**, 1184; Chem. Centrbl., **1881**, 469; Ztschr. anal. Chem., **22**, 245; Chem. Ztg., **5**, 304; J. Chem. Soc. (Lond.), **40**, 760; Bull. soc. chim. (2), **37**, 92; Wagner's Jsb., **27**, 355; Dingl. pol. J., **242**, 391.

Determination by addition of a neutral solution of manganese to standard solution of permanganate until latter is colorless.

1881: 7. EMMERTON, F. A. Chemical Methods for Analysing Rail Steel.

Trans. Am. Inst. Min. Eng., **10**, 203; Jsb. Chem., **1882**, 1289; J. Iron Steel Inst., **1881**, b, 653; Eng. Min. J., **32**, 319; Dingl. pol. J., **246**, 239.

Determination by the Volhard method. (1879: 14.)

1881: 8. FORD, S. A. Method for the Estimation of Manganese in Spiegels, Irons, and Steels.

Trans. Am. Inst. Min. Eng., **9**, 397; Eng. Min. J., **32**, 6.

Precipitation by means of potassium chlorate, re-solution in acid and final precipitation as manganese ammonium phosphate.

1881: 9. FORGUIGNON. Recherches sur la fonte malleable et sur le recuit des aciers.

Ann. chim. phys. (5), **23**, 447.

Determination in steel by the Leclerc method. See 1872: 7.

1881: 10. ILES, M. W. Decomposition of Slags and Silicates.

Chem. News, **43**, 78; J. Chem. Soc. (Lond.), **40**, 645.

Volumetric method of determination through the formation of manganate by fusion with alkali hydroxide. (Unimportant.)

1881: 11. KENT, W. Manganese Determination in Steel.

Trans. Am. Inst. Min. Eng., **10**, 101; J. Iron Steel Inst., **1881**, b, 655; School Mines Quart., **3**, 51.

General discussion of methods. Results of twelve chemists upon the same sample.

1881: 12. LUNGE, G. Zur Orientirung über die Frage des "Weldonschlammes."

Dingl. pol. J., **242**, 371.

Reply to Post, 1880: 14.

1881: 13. LUNGE, G. Bericht an die Generalversammlung des Vereins deutschen Sodafabrikanten.

Chem. Ind., **4**, 373; Dingl. pol. J., **243**, 493; J. Chem. Soc. (Lond.), **42**, 895; J. Soc. Chem. Ind., **1**, 93.

Comments on Fresenius-Will (1843:3), Bunsen (1853:1), and iron methods for the determination of the peroxide.

1881: 14. v. REIS, M. A. Ueber die Benutzung einiger oxalsauren Salze in der Analyse.

Ber., **14**, 1178; Jsb. Chem., **1881**, 1155.

Detection in the presence of phosphoric acid by the aid of oxalates.

1881: 15. SÄRNSTRÖM, C. G. Ueber Manganbestimmung durch Titriren mit Chamäleonlösung.

* Jern.-Kont. Ann., **1881**, Heft 7; Berg- u. hüttenm. Ztg., **40**, 425; Iron, **19**, 104; Jsb. Chem., **1881**, 1188; Ztschr. anal. Chem., **22**, 84; Chem. Ztg., **5**, 895; Chem. News, **47**, 177; Wagner's Jsb., **27**, 358; J. Iron Steel Inst., **1883**, a, 417; Scientif. Am. Suppl., **1882**, 5167.

Precipitation of iron and manganese by sodium bicarbonate, and titration with potassium permanganate in the presence of the precipitate.

1881: 16. TERREIL, A. Liqueur volumétrique pour le dosage des composés suroxygénés ou agissant comme corps oxydants.

Bull. soc. chim. (2), **35**, 551; Chem. Centrbl., **1881**, 569; Jsb. Chem., **1881**, 1155.

Determination of peroxide with the aid of ferrous salts and permanganate.

1881: 17. TROILIUS, M. Chemical Methods for Analysing Rail Steel.

Trans. Am. Inst. Min. Eng., **10**, 173; Eng. Min. J., **32**, 300; J. Iron Steel Inst., **1881**, b, 654; School Mines Quart., **3**, 52.

Separation from iron by the acetate method, precipitation by bromine in ammoniacal solution, and ignition to mangano-manganic oxide.

1881: 18. WILLIAMS, F. A. A Volumetric Estimation of Manganese in Pig Iron and Steel.

Trans. Am. Inst. Min. Eng., **10**, 100; Jsb. Chem., **1882**, 1288; Dingl. pol. J., **246**, 241; J. Iron Steel Inst., **1881**, b, 656; Iron, **18**, 540; Wagner's Jsb., **28**, 15.

Precipitation by means of potassium chlorate, solution in oxalic acid, and titration for the excess of the latter.

1882: 1. DE BOISBAUDRAN, L. Séparation du gallium.

C. R., **94**, 1625; Jsb. Chem., **1882**, 1296; Chem. News, **46**, 3.

Nine methods for the separation from gallium.

1882: 2. CABOT, J. W. Chemical Methods for Analysing Rail Steel.

Trans. Am. Inst. Min. Eng., **10**, 191.

Separation from iron by the acetate method, and precipitation by bromine.

1882: 3. DARTON, N. H. On the Estimation of and Separation of Manganese.

Scientif. Am. Supplem. **1882**, 5168; Chem. Ind., **5**, 201; Wagner's Jsb., **28**, 448; Rep. anal. Chem., **2**, 216; J. Soc. Chem. Ind., **1**, 468.

Determination of peroxide in pyrolusite by solution with potassium oxalate, absorption of carbon dioxide by barium hydroxide, and titration for the excess of the latter.

1882: 4. DEWEY, F. P. Chemical Methods for Analysing Rail Steel.

Trans. Am. Inst. Min. Eng., **10**, 194.

Determination by Kent's method. See 1881: 11.

1882: 5. DIEHL, W. Zur maassanalytische Bestimmung der Hyperoxyde.

Dingl. pol. J., **246**, 196; Chem. Ind., **6**, 157; Ztschr. anal. Chem. (1887), **26**, 296; Jsb. Chem., **1882**, 1290; **1883**, 1567; Chem. Centrbl., **1883**, 6; J. Chem. Soc. (Lond.), **44**, 242; Ber., **16**, 2319; Wagner's Jsb., **29**, 439; Rep. anal. Chem., **3**, 231; J. Soc. Chem. Ind., **3**, 115; Chem.-techn. Rep., **22**, 236.

Determination of peroxide by digestion with hydrochloric acid and potassium iodide, and direct titration with thiosulphate.

1882: 6. DUNN, J. D. Contributions to the History of Oxides of Manganese.

Chem. News, **45**, 137; Jsb. Chem., **1882**, 302.

A study of the oxides of manganese and their relation to the Guyard method. See 1863: 2.

1882: 7. GUYARD, A. Dosage du zinc à l'aide d'un nouveau réactif et séparation de ce métal d'avec les alcalis, la chaux, la magnésie, le manganèse, le cuivre, le nickel et le cobalt.

Monit. scientif. (3), **12**, 778; Jsb. Chem., **1882**, 1293.

Separation from zinc by ammonium sulphocarbonate.

: 8. HASWELL, A. E. Maassanalytische Bestimmung und Trennung der Metalle.

Rep. anal. Chem., **2**, 243; J. Iron. Steel Inst., **1882**, 743.
Determination by Volhard method. No details.

: 9. JEWETT, J. Influence of Acetic Acid on the Separation of Iron as a Basic Acetate from Manganese, Zinc, Cobalt, and Nickel.

Am. Chem. J., **1**, 251; Ztschr. anal. Chem., **21**, 262.
See title.

: 10. KEISER, E. H. The Electrolytic Separation of Manganese in Pig Iron and Steel.

Eng. Min. J., **33**, 131.
See title.

: 11. LEDEBUR, A. Eine colorimetrische Manganbestimmung.

Berg- u. hüttenm. Ztg., **41**, 417; Jsb. Chem., **1882**, 1288; Chem. Centrbl., **1882**, 733; Ztschr. anal. Chem., **22**, 607; Ber., **15**, 2926; Wagner's Jsb., **29**, 15; Stahl u. Eisen, **2**, 626; Rep. anal. Chem., **2**, 346; J. Chem. Soc. (Lond.), **44**, 242; J. Soc. Chem. Ind., **2**, 249; Techn.-chem. Jahrb., **5**, 11; Dingl. pol. J., **248**, 215; Chem. -techn. Rep., **21**, b, 211.
Oxidation by lead peroxide to permanganic acid and comparison with solutions of potassium permanganate.

: 12. LEFORT, J., and THIEBAULT, P. De l'influence de la gomme arabique dans certaines réactions chimiques.

J. de pharm. (5), **6**, 169; Pharm. J. Trans. (3), **13**, 301; Jsb. Chem., **1882**, 1259.
Influence of gum arabic on the precipitation as sulphide.

: 13. LÖWE, J. Ueber den qualitativen Nachweis und quantitativen Bestimmung des Arsens—sowie einiger in geringer Menge in gediegenen Kupfer des Handels vorkommenden Metalle.

Ztschr. anal. Chem., **21**, 516.
Separation in the analysis of commercial copper.

: 14. MILLS, E. J., and BECKET, J. H. Researches on Chemical Equivalence.

Phil. Mag. (5), **13**, 170.
Separation from nickel.

: 15. TAMM, A. Die üblichsten Eisenanalysen. (*Title from Chem. Centrbl.*)

* Jern.-Kont. Ann., **1882**, 123; Chem. Centrbl., **1882**, 766; Jsb. Chem., **1882**, 1288; Berg- u. hüttenm. Ztg., **41**, 448.
Comparison of methods of determination.

1882: 16. TROILIUS, M. Bestämning af mangan i jern.

Jern.-Kont. Ann., **1882**, 526; Berg- u. hüttenm. Ztg., **42**, 255; Jsb. Chem., **1883**, 1568 and 1674; Ber., **16**, 1690; Wagner's Jsb., **29**, 19; Rep. anal. Chem., **3**, 189; J. Soc. Chem. Ind., **2**, 428; Dingl. pol. J., **250**, 417.

Precipitation by means of potassium chlorate, solution and separation of iron, re-precipitation by bromine, and weighing as protosesquioxide.

1882: 17. WAGNER, A. Ueber das Verhalten von Braunstein und Chlorkalk beim Glühen mit Chromoxyd und kohlensaurem Natron unter Ausschluss der Luft.

Ztschr. anal. Chem., **21**, 493; Chem. News, **45**, 80.

Determination of peroxide from the amount of chromate formed during the heating.

1883: 1. GOETZ. Die Bestimmung des Mangans in Eisen.

Dingl. pol. J., **248**, 215.

Colorimetric determination by oxidation to permanganic acid by means of lead peroxide.

1883: 2. GUYARD, A. Recherche qualitative du manganèse dans le zinc de commerce, les cendrése de zinc et les calamines,—et recherches du bismuth dans le plomb commercial, au moyen de l'électrolyse.

C. R., **97**, 673; Bull. soc. chim. (2), **40**, 420; Jsb. Chem., 1883, 1514; Ber., **16**, 2691; Chem. News, **48**, 193; J. Chem. Soc. (Lond.) **46**, 368 and 640; Chem. Ztg., **7**, 1611; Rep. anal. Chem., **3**, 379; Berg- u. hüttenm. Ztg., **42**, 587.

Permanganic acid formed by electrolysis.

1883: 3. HARVEY, J. W. C. New Process for the Rapid Volumetric Estimation of Binoxide of Manganese.

Chem. News. **47**, 2; Jsb. Chem., **1883**, 1566; Chem. Centrbl., 1883, 199; J. Chem. Soc. (Lond.), **44**, 513; Ztschr. anal. Chem., **23**, 60; Ber., **16**, 262; Chem. Ztg., **7**, 141; Chem. Ind., **6**, 82; Chem.-techn. Rep., **22**, 236; Wagner's Jsb., **29**, 437; Dingl. pol. J., **248**, 303.

Determination of peroxide by solution in an excess of stannous chloride, addition of ferric chloride, and titration for the ferrous chloride formed.

1883: 4. HAMPE, W. Zwei neue maassanalytische Manganbestimmungsmethoden.

Chem. Ztg., **7**, 1103; Jsb. Chem., **1883**, 1565; Ber., **16**, 2531; Stahl. u. Eisen, **3**, 638; Wagner's Jsb., **30**, 141; Berg- u. hüttenm. Ztg., **42**, 536; Ztschr. anal Chem. (1885), **24**, 422; Techn.-chem. Jahrb., **6**, 27.

Precipitation by means of potassium chlorate, solution by ferrous-ammonium sulphate, and titration for the excess of the latter. Evaporation of nitric-acid solution, heating of residue with phosphoric acid, and titration of the phosphate formed with a solution of ferrous sulphate.

883: 5. HEMPEL, C. W. Zur maassanalytischen Bestimmung der Hyperoxyde.

Dingl. pol. J., **247**, 144.
Criticism of Diehl's article. See 1882: 5.

883: 6. v. JÜPTNER, H. Das übermangansaure Kali als Titrirflüssigkeit.

Oester. Ztschr. Berg- u. Hüttenw., **31**, 502.
Comments on Volhard method. (1879: 14.)

883: 7. KERL, B. (Title unknown.)

Dingl. pol. J., **250**, 416.
Confirmation of Särnström method. See 1881: 15.

883: 8. KNOP, W. Zur Analyse der Silicate.

Ber. königl. Sach. Ges. Wiss. (math.-phys. Classe), **1882**, 35; Ztschr. anal. Chem., **22**, 558.
Determination in silicates. Brief reference only.

883: 9. MACKINTOSH, B. The Volumetric Determination of Manganese.

Trans. Am. Inst. Min. Eng., **12**, 79; Chem. News, **48**, 176; Am, Chem. J., **5**, 290; Iron, **22**, 464; Jsb. Chem., **1883**, 1569; J. Iron Steel Inst., **1883**, b, 761; J. Chem. Soc. (Lond.), **46**, 220; Ber., **16**, 2939; Berg- u. hüttenm. Ztg., **43**, 302.
Precipitation by potassium chlorate. Williams method. See 1881: 18.

883: 10. MEINEKE, C. Titrirung des Mangans durch übermangansaures Kali.

Rep. anal. Chem., **3**, 337; Jsb. Chem., **1883**, 1567; Ztschr. anal. Chem. (1885), **24**, 430; Ber., **16**, 3074; Wagner's Jsb., **29**, 437; Berg- u. hüttenm. Ztg., **43**, 23; Chem. Ztg., **7**, 1609.
Separation from iron by zinc oxide, addition of the solution to an excess of permanganate, and titration for the excess with antimonious chloride.

883: 11. MEINEKE, C. See 1883: 10.

883: 12. ORLOWSKI, A. Ersetzung des Schwefelwasserstoffs bei dem systematischen Gang der qualitativen chemischen Analyse durch unterschwefligsaures Ammon.

Ztschr. anal. Chem., **22**, 364.
Detection of manganese.

1883: 13. RAIMOND, E. Nouvelle méthode volumétrique de dosage du manganèse dans les aciers, fontes, ferro-manganèses, etc.

Rev. univers. des mines, **13**, 460; * Armengaud. Publ. Ind., **1883**, 189; Jsb. Chem., **1883**, 1673; Chem. Centrbl., **1884**, 156; Chem. News, **48**, 23; Chem. Ztg., **8**, 344; Wagner's Jsb., **29**, 18; J. Iron Steel Inst., **1883**, b, 783; Chem.-techn. Rep., **23**, a, 236; Rep. anal. Chem., **4**, 137; Berg- u. hüttenm. Ztg., **43**, 166; J. Chem. Soc. (Lond.), **48**, 840; Dingl. pol. J., **250**, 416.

Precipitation by means of potassium chlorate, and use of ferrous sulphate.

1883: 14. SÄRNSTRÖM, C. G. Ueber volumetrische Manganbestimmung im Eisen.

Berg- u. hüttenm. Ztg., **42**, 436; Wagner's Jsb., **29**, 19; Dingl. pol. J., **250**, 436.

Comments on Schoeffel and Donath method of determination. See 1883: 17.

1883: 15. SÄRNSTRÖM, C. G. Tillägg till uppsat sen om manganprof medelst titrering.

Jern.-Kont. Ann., **1883**, 400; Stahl u. Eisen, **4**, 127; Wagner's Jsb., **30**, 23.

See 1881: 15.

1883: 16. SCHMITT. Einführung einheitlicher Untersuchungsmethoden bei Manganbestimmungen in Eisen.

Stahl u. Eisen, **3**, 487; Wagner's Jsb., **29**, 18; Oester. Ztschr. Berg- u. Hüttenw., **32**, 164.

Request for the appointment of a commission to propose uniform methods for the determination of manganese.

1883: 17. SCHOEFFEL, R., and DONATH, E. Ueber eine neue Methode der volumetrischen Bestimmung des Mangans, insbesondere in Eisen und Stahl.

Oester. Ztschr. Berg- u. Hüttenw., **31**, 229; Jsb. Chem., **1883**, 1567; Chem. Centrbl., **1883**, 332; Dingl. pol. J., **248**, 421; Chem. Ztg., **7**, 587; Ztschr. anal. Chem. (1885), **24**, 427; Ber., **16**, 1690; Wagner's Jsb., **29**, 15; Stahl. u. Eisen, **3**, 374; J. Iron Steel Inst., **1883**, a, 381; Rep. anal. Chem., **3**, 207; Berg- u. hüttenm. Ztg., **42**, 231; Pharm. Runds, **1883**, 352; Chem.-techn. Rep., **22**, b, 235.

Volumetric determination by the addition of the manganese solution to alkaline permanganate solution.

1883: 18. SCHUCHT. Zur Elektrolyse.

Ztschr. anal. Chem., **22**, 493; Jsb. Chem., **1883**, 1512; Dingl. pol. J., **254**, 298.

Electrolytic precipitation.

1883: 19. STONE, G. C. The Determination of Manganese in Spiegel.

Trans. Am. Inst. Min. Eng., **11**, 323; Eng. Min. J., **35**, 318; Iron, **22**, 378; J. Iron Steel Inst., **1883**, a, 366; Dingl. pol. J., **250**, 416; Techn.-chem. Jahrb., **6**, 27.

Precipitation by means of potassium chlorate, solution in oxalic acid, and titration with permanganate. Doubt as to the composition of the precipitate produced by the chlorate.

1883: 20. STONE, G. C. The Volumetric Determination of Manganese.

Chem. News, **48**, 273; Jsb. Chem., **1883**, 1569; J. Chem. Soc. (Lond.), **46**, 499; Wagner's Jsb., **29**, 19.

Reply to Mackintosh. 1883: 9.

1883: 21. TROILIUS, M. The Determination of Manganese in Spiegel, Ferro-manganese, Steel, etc.

Trans. Am. Inst. Min. Eng., **12**, 73; J. Iron Steel Inst., **1883**, b, 761; Iron, **22**, 397; Jern.-Kont. Ann., **1883**, 466; Berg- u. hüttenm. Ztg., **43**, 284; Jsb. Chem., **1884**, 1599; Chem. Centrbl., **1884**, 716; Ber., **17**, 386, Ref.; J. Chem. Soc. (Lond.), **48**, 597; Stahl. u. Eisen, **4**, 126; Wagner's Jsb., **30**, 18; J. Soc. Chem. Ind., **3**, 523; **4**, 137.

Use of potassium bichromate in connection with the Williams method of determination. See 1881: 18.

1883: 22. WOLFF, N. Ueber die Anwendung eines mit Bromdämpfen geschwängerten Luftstromes zur Fällung des Mangans.

Ztschr. anal. Chem., **22**, 520; Jsb. Chem., **1883**, 1566; Chem. Centrbl., **1884**, 156; J. Chem. Soc. (Lond.), **46**, 640; Ber., **16**, 3075; Chem. News, **49**, 201; Wagner's Jsb., **29**, 438; Rep. anal. Chem., **3**, 364; J. Am. Chem. Soc., **5**, 244.

Precipitation by bromine in ammoniacal solution.

1883: 23. ZULKOWSKY, K. Zur Bestimmung des Mangans in Eisenerzen. (*Title from Dingl. pol. J.*)

* Ber. oester. chem. Ges., **1883**, 3; Jsb. Chem., **1883**, 1569; J. Chem. Soc., **46**, 116; Dingl. pol. J., **248**, 259; Wagner's Jsb., **28**, 1; * Chemiker u. Droguist, **1883**, 62; Rep. anal. Chem., **3**, 124; Chem.-techn. Rep., **22**, b, 236.

Precipitation as sulphide, ignition, solution of the residue in sulphurous and nitric acids, and titration with permanganate.

1884: 1. ANGER, C. Prüfung der Mangantitrirung mit Kaliumpermanganat in alkalischer Lösung.

Stahl. u. Eisen, **4**, 156; Wagner's Jsb., **30**, 397; Dingl. pol. J., **254**, 139.

Titration with permanganate in the presence of sodium carbonate in excess.

1884: 2. ATKINSON, A. J. Volumetric Estimation of Manganese.

Chem. News, **49**, 25; Jsb. Chem., **1884**, 1599.

Determination in spiegeleisen by difference, after determination of the iron volumetrically. See Holdich, 1884: 8.

1884: 3. BLOXAM, C. L. Estimation of Manganese in Cast Iron and Spiegeleisen.

Chem. News, **50**, 112; Jsb. Chem., **1884**, 1599; Chem. Centrbl., **1884**, 849; Ber., **17**, 508, Ref.; Chem. Ztg., **8**, 1436; J. Iron Steel Inst., **1884**, b, 584; J. Chem. Soc., **48**, 84; Wagner's Jsb., **31**, 18; J. Am. Chem. Soc., **6**, 242; Berg- u. hüttenm. Ztg., **43**, 520; Iron, **24**, 271; Chem. Ind., **7**, 362; Chem.-techn. Rep., **23**, b, 186; **24**, 249.

Separation from iron by double acetate precipitation with the addition of phosphates, and final precipitation of manganese as phosphate.

1884: 4. CLASSEN. A. Entgegnung. (Wieland, 1884: 17.)

Ber., **17**, 2351; Jsb. Chem., **1884**, 1540; Ztschr. anal. Chem., **24**, 247.

Electrolytic determination. See also 1885: 4.

1884: 5. CLASSEN, A. Quantitative Analyse durch Elektrolyse.

Ber., **17**, 2472 and 2484; Jsb. Chem., **1884**, 1543; Ztschr. anal. Chem., **24**, 255.

Separation from copper and chromium by electrolysis.

1884: 6. GMELIN, O. Chemische Notizen für der Giesserei-Techniker.

Oester. Ztschr. Berg- u. Hüttenw., **1884**, No. 49; Berg- u. hüttenm. Ztg., **44**, 23, Ref.

A modification of the Volhard method of determination.

1884: 7. HANOWSKY. Ueber eine neue Anwendung des Wasserstoffsuperoxyds in der chemischen Analyse. (*Title from Chem. Ztg.*)

* Ber. oester. Ges. z. Förd. Chem. Ind., **1884**, 8; Jsb. Chem., **1884**, 1562; Rep. anal. Chem., **1884**, 220; Chem. Ztg., **8**, 789.

Precipitation by hydrogen peroxide and ignition to manganomanganic oxide.

1884: 8. HOLDICH. Volumetric Estimation of Manganese.

Chem. News, **49**, 9 and 57; Jsb. Chem., **1884**, 1598.

Determination in spiegeleisen by difference, after volumetric determination of the iron.

1884: 9. HOLTHOF, C. Ueber Fällung des Mangans mit Brom.

Ztschr. anal. Chem., **23**, 491; Jsb. Chem., **1884**, 1598; Chem. Centrbl., **1885**, 67; Ber., **18**, 34, Ref.; Wagner's Jsb., **30**, 397; Berg- u. hüttenm. Ztg., **44**, 55; J. Soc. Chem. Ind., **4**, 367.

Precipitation by bromine in ammoniacal solution. Comments on Beilstein and Jawein chlorate method. See 1879: 1.

1884: 10. ILES, M. W. Manganese in Slags Formed by Argentiferous Lead Smelting.

School Mines Quart., **1884**, 223; Chem. News, **50**, 194; Berg- u. hüttenm. Ztg., **44**, 16.

Comments on Haswell's method of determination. See 1880: 5.

1884: 11. LEDEBUR, A. Ueber Manganbestimmung im Eisenbetriebe.

Chem. Ztg., **8**, 910, 927, and 963; Iron, **24**, 558; Jsb. Chem., **1884**, 1597; J. Chem. Soc. (Lond.), **44**, 242; J. Iron Steel Inst., **1884**, a, 269; Berg- u. hüttenm. Ztg., **43**, 452; J. Soc. Chem. Ind., **3**, 522.

Comments on the Pattinson (1879: 9), Hampe (1883: 4), and Volhard (1879: 14) methods.

1884: 12. MACKINTOSH, J. B. The Influence of Organic Matter and Iron on the Volumetric Determination of Manganese.

Trans. Am. Inst. Min. Eng., **13**, 39; Iron, **24**, 224; Jsb. Chem., **1884**, 1599; Chem. News, **50**, 75; J. Chem. Soc. (Lond.), **48**, 85; Ber., **18**, 126; Chem. Ztg., **8**, 1144; Berg- u. hüttenm. Ztg., **43**, 302; Bull. soc. chim. (2), **41**, 354; Eng. Min. J., **37**, 440.

Influence of organic matter on the Williams method of determination (1881: 18).

1884: 13. MACKINTOSH, J. B. Manganese Methods.

School Mines Quart., **6**, 35.

Comparison of methods.

1884: 14. MAUMENÉ, E. J. Sur l'existence du manganèse dans les animaux et les plantes et sur son rôle dans la vie animale.

Bull. soc. chim. (2), **41**, 451; (2), **42**, 305; C. R., **98**, 1416; Jsb. Chem., **1884**, 1436.

Detection in plants, wines, and cereals by oxidation to permanganic acids. Various procedures briefly mentioned.

1884: 15. MEINEKE, C. Bestimmung des Mangans durch Permanganat. (*Title from Rep. anal. Chem.*)

* Chem. Verst. Mitt., **1884**, 63; Rep. anal. Chem., **5**, 1; Jsb. Chem. **1884**, 1596; Chem. Ztg., **9**, 432; Ztschr. anal. Chem., **24**, 423; Chem. Ind., **8**, 86; Ber., **18**, 125, Ref.; J. Am. Chem. Soc., **7**, 91; Dingl. pol. J., **257**, 202.

Comments on Guyard (1863: 2), Volhard (1879: 14), Morawski and Stingl (1878: 4), and Ledebur (1884: 11) methods of determination.

1884: 16. STONE, G. C. The Determination of Manganese in Spiegel.

Trans. Am. Inst. Min. Eng., **12**, 295 and 514; School Mines Quart., **6**, 24; J. Iron Steel Inst., **1884**, a, 335; Eng. Min. J., **36**, 228; **37**, 138; Berg- u. hüttenm. Ztg., **42**, 442.

Shows variation in results obtained by different chemists when working upon the same sample.

1884: 17. WIELAND, J. Ueber elektrolytische Bestimmungen.

Ber., **17**, 1611 and 2931; Jsb. Chem., **1884**, 1542; Chem. News, **50**, 211.

Electrolytic determination. See Classen, 1884: 4.

1884: 18. WOLFF, N. Eine maassanalytische Bestimmung des Mangans.

Stahl u. Eisen, **4**, 702; J. Iron Steel Inst., **1885**, a, 301; Wagner's Jsb., **31**, 12; Berg- u. hüttenm. Ztg., **44**, 20; Dingl. pol. J., **257**, 199; Chem.-techn. Rep., **23**, b, 186.

Separation from iron by means of zinc oxide, and titration with permanganate in the presence of the iron precipitate.

1885: 1. BLOXAM, C. L. On the Detection of Iron, Aluminium, Chromium, Manganese, Cobalt, Nickel, Calcium, and Magnesiums (as Phosphates) in the Precipitate Produced by Ammonia.

Chem. News, **52**, 109; Chem. Centrbl., **1885**, 942; J. Chem. Soc., **48**, 1264; Chem. Ind., **8**, 324.

Detection by means of phosphates.

1885: 2. CHARPENTIER, P. Sur une nouvelle méthode d'analyse volumétrique, applicable aux essais des bioxydes de manganèse.

C. R., **101**, 316; Chem. Centrbl., **1885**, 715; Jsb. Chem., **1885**, 1937; Chem. News, **52**, 87; J. Iron Steel Inst., **1886**, a, 401; Ztschr. anal. Chem., **28**, 733; J. Chem. Soc. (Lond.), **48**, 1162; Wagner's Jsb., **32**, 345; Rep. anal. Chem., **5**, 352; Dingl. pol. J., **259**, 103; Chem.-techn. Rep., **24**, b, 248; **25**, a, 207; Chem. Ind., **9**, 59.

Determination of peroxide by passage of chlorine evolved on solution in hydrochloric acid into ferrous sulphate solution, and titration for ferric iron with potassium hydroxide in presence of potassium sulphocyanide.

1885: 3. CHEEVER, B. W. Estimation of Manganese, Carbon, and Phosphorus in Iron and Steel.

Trans. Am. Inst. Min. Eng., **14**, 372; J. Iron Steel Inst., **1885**, 736.

Comments on the Williams method. (1881: 18)

1885: 4. CLASSEN, A. Bemerkungen zu der Antwort des Herrn Wieland.

Ber., **18**, 168.

Determination by electrolysis. See 1884: 4 and 1884: 17.

1885: 5. CLASSEN, A. Quantitative Analyse durch Elektrolyse.

Ber., **18**, 1793; Jsb. Chem., **1885**, 1883; Bull. soc. chim. (2), **45**, 893; Dingl. pol. J., **259**, 93; Ztschr. anal. Chem., **25**, 110.

Electrolytic separation from iron.

1885: 6. DEANE, L. M. Ferricyanide of Manganese.

Chem. News, **51**, 164 and 248; Jsb. Chem., **1885**, 1937.

Solubility of manganese ferricyanide. Note on an error in Fresenius' Qualitative Analysis. See 1885: 8.

1885: 7. DIEHL, W. Zur Bestimmung des Mangans.

Chem. Ind., **8**, 206; Chem. Centrbl., **1885**, 713; Jsb. Chem., **1885**, 1934; J. Chem. Soc. (Lond.), **50**, 101; Wagner's Jsb., **31**, 89; Rep. anal. Chem., **5**, 300; Dingl. pol. J., **258**, 95; Chem. Ztg., **8**, 1502; Chem.-techn. Rep., **24**, b, 248.

Precipitation by bromine and ammonia, solution in hydrochloric acid and estimation of the iron by the amount of iodine liberated from potassium iodide.

1885: 8. DRAPER, C. N. Solubility of Manganese Ferricyanide in Hydrochloric Acid.

Chem. News, **51**, 226; Jsb. Chem., **1885**, 1937.
See 1885: 6.

1885: 9. HAMPE, W. Ein einfaches Verfahren zur Trennung des Zinks von allen Metallen seiner Gruppe.

Chem. Ztg., **9**, 543; Chem. Centrbl., **1885**, 603; Jsb. Chem., **1885**, 1938; Ztschr. anal. Chem., **24**, 588.

Separation from zinc by precipitation with hydrogen sulphide in presence of formates.

1885: 10. HAMPE, W. Die maassanalytische Bestimmung des Mangans in Legirungen, Mineralien u. s. w. mittelst Kaliumchlorats.

Chem. Ztg., **9**, 1083 and 1515; Berg- u. hüttenm. Ztg., **44**, 328; Monit. scientif., **27**, 1046; Chem. Centrbl., **1885**, 714; Jsb. Chem., **1885**, 1936; Ber., **18**, 580, Ref.; J. Iron Steel Inst., **1885**, b, 652; Wagner's Jsb., **31**, 311; Rep. anal. Chem., **5**, 299; Techn.-chem. Jahrb., **8**, 17 and 83; J. Soc. Chem. Ind., **4**, 690; Analyst, **10**, 191.

Precipitation with potassium chlorate, solution of the precipitate, addition of ferrous sulphate, and titration with permanganate. See 1883: 4.

1885: 11. V. JÜPTNER, H. Eine neue Manganbestimmungsmethode auf gewichtsanalytischem Wege.

Chem. Ztg., **9**, 692; Jsb. Chem., **1885**, 1935; Ztschr. anal. Chem., **25**, 217; J. Iron Steel Inst., **1885**, a, 247; Wagner's Jsb., **31**, 14; J. Soc. Chem. Ind., **4**, 510; Dingl. pol. J., **257**, 201; Analyst, **10**, 149; Chem.-techn. Rep., **24**, 249.

Precipitation as manganous sulphide, after removal of the iron with barium carbonate, solution of the precipitate in acetic acid, evaporation and ignition to mangano-manganic oxide.

1885: 12. KALMANN, W., and SMOLKA, A. Ueber eine neue Methode zur Bestimmung des Mangans in Spiegeleisen, Ferromangan und den wichtigsten Erzen.

Wien. Acad. Ber. (2 Abt.), **91**, 49; Monatsh., **6**, 65; Chem. Centrbl., **1885**, 235; Jsb. Chem., **1885**, 1936; Ztschr. anal. Chem., **24**, 590;

1886: 4. BEIN, S. Ueber die quantitative Abscheidung und Bestimmung des Zinks.

Rep. anal. Chem., **1886,** 275; Jsb. Chem., **1886,** 1939.
Separation from iron by the succinate method, and from zinc by treating the ignited oxides with acetic acid.

1886: 5. BLUM, L. Ueber die directe Trennung des Mangans von Eisen.

Ztschr. anal. Chem., **25,** 519; Chem. Centrbl., **1887,** 97; Jsb. Chem., **1886,** 1934; Chem. News, **55,** 236; Chem. Ztg., **11,** 251; Ber., **19,** 850, Ref.; J. Chem. Soc. (Lond.), **52,** 183; Chem. Ind., **9,** 383; Wagner's Jsb., **32,** 344; Rep. anal. Chem., **6,** 662; Analyst, **11,** 234; J. Am. Chem. Soc., **9,** 10; Dingl. pol. J., **262,** 335.
Separation from iron by precipitation as ferrocyanide from ammoniacal tartrate solution.

1886: 6. CARNOT, A. Séparation successive du cuivre, du cadmium, du zinc et du nickel ou du cobalt (fer et manganèse).

Bull. soc. chim. (2), **46,** 812; C. R., **102,** 621 and 678; Eng. Min. J., **41,** 340; Jsb. Chem., **1886,** 1948; Chem. News, **53,** 196; Ztschr. anal. Chem. (1889), **28,** 344; Chem. Ztg., **11,** 4, Ref.; Ber., **19,** 364, Ref.; J. Chem. Soc. (Lond.), **50,** 650; J. Iron Steel Inst., **1887,** a, 470.
Separation from nickel and iron by means of hydrogen sulphide in acetic acid solution.

1886: 7. CHRISTENSEN, O. T. Beiträge zur Chemie des Mangans und des Fluors.

J. prakt. Chem., **34,** 41; **35,** 161; Chem. News, **54,** 96; **55,** 153.
Detection by the formation of permanganic acid on the electrolysis of the manganese salt in hydrofluoric acid solution.

1886: 8. CHEEVER, B. W. Colorimetric Estimation of Manganese in Steel.

Trans. Am. Inst. Min. Eng., **15,** 102; J. Iron Steel Inst., **1885,** b, 736; J. Anal. Chem., **1,** 88.
Criticisms of the method of determination by means of lead peroxide and nitric acid.

1886: 9. CLASSEN, A. See 1884: 4.

1886: 10. CLASSEN, A. See 1884: 5.

1886: 11. CLASSEN, A., and LUDWIG, R. Quantitative Analyse durch Elektrolyse.

Ber., **19,** 323; Jsb. Chem., **1886,** 1894.
Separation from mercury by electrolysis.

1886: 12. DEANE, L. M. On the Separation of Silica in the Estimation of Manganese in Pig Iron, and On the Estimation of Phosphorus in Pig Iron and Steel.

Chem. News, **54**, 174; Jsb. Chem., **1886**, 1932; Ber., **19**, 851, Ref.; J. Chem. Soc. (Lond.), **52**, 183; Chem.-techn. Centr. Anz., **1887**, 187; Chem.-techn. Rep., **26**, a, 295.

Separation from iron by the basic acetate method, and final separation from silica after igniting and weighing the manganese oxide.

1886: 13. HUNT, A. E. The Estimation of Manganese in Iron and Steel by the Color Method.

Trans. Am. Inst. Min. Eng., **15**, 104; J. Iron Steel Inst., **1886**, b, 1020; J. Anal. Chem., **1**, 89.

Oxidation with lead peroxide in the presence of nitric acid.

1886: 14. LANGBEIN, E. Zur Nickelanalyse.

Rep. anal. Chem., **1886**, 423; Jsb. Chem., **1886**, 1937; Dingl. pol. J., **261**, 495.

Separation from nickel by electrolysis.

1886: 14a. LÖSEKANN, G., and MEYER, T. Eine neue Methode der Zinkbestimmung.

Chem. Ztg., **10**, 729.

Separation from zinc by means of phosphate impracticable.

1886: 15. MEINEKE, C. Eine Methode schneller Bestimmung des Mangans in Eisensorten mittels Permanganat.

Rep. anal. Chem., **6**, 252; Jsb. Chem., **1886**, 1933; Ber., **19**, 464, Ref.; Chem. Ind., **9**, 194; Stahl u. Eisen, **6**, 444; Wagner's Jsb., **32**, 5; Berg- u. hüttenm. Ztg., **46**, 43; J. Soc. Chem. Ind., **5**, 508; Techn.-chem. Jahrb., **9**, 18; Chem.-techn. Rep., **25**, a, 205.

Use of permanganate method (Meineke) with antimonious chloride. See 1883: 10.

1886: 16. MÜLLER, C. G. Ueber eine schnelle und scharfe Methode zur gewichtsanalytischen Bestimmung des Mangans im Spiegeleisen und Ferromangan.

Stahl u. Eisen, **6**, 98; Wagner's Jsb., **32**, 5; Berg- u. hüttenm. Ztg., **45**, 349; Techn.-chem. Jahrb., **8**, 17; J. Iron Steel Inst., **1886**, 392.

Separation from iron by the basic acetate method, precipitation by bromine, and subsequently as manganous carbonate; or, separation by the acetate method, and re-precipitation with hydrogen peroxide and determination as mangano-manganic oxide.

1886: 17. MÜLLER, C. G. Ueber die neue Meinekesche Manganbestimmung.

Stahl. u. Eisen, **6**, 590; Chem. Ztg., **11**, 216, Rep.; Wagner's Jsb., **32**, 5; Rep. anal. Chem., **6**, 595; Berg- u. hüttenm. Ztg., **45**, 452; J. Iron Steel Inst., **1886**, 1022; Chem.-techn. Rep., **25**, a, 206.

Comments on the Meineke method. (1883: 10.)

1886: 18. MOORE, T. Quantitative Chemical Analysis by Electrolysis.

Chem. News, **53**, 209; Jsb. Chem., **1886**, 1895; J. Chem. Soc. (Lond.), **50**, 921; Eng. Min. J., **41**, 371.

Electrolytic deposition and estimation as oxide.

1886: 19. MOORE, T. On the Estimation of Nickel in Mattes, Ores, Slags, etc.

Chem. News, **54**, 300; Jsb. Chem., **1886**, 1938; Ztschr. anal. Chem., **26**, 732.

Separation from nickel by electrolysis.

1886: 20. PATTINSON, J. The Volumetric Test for Manganese.

J. Soc. Chem. Ind., **5**, 422; Monit. scientif., **28**, 1048; Jsb. Chem., **1886**, 1934.

Reply to the criticisms of Atkinson. See 1886: 1.

1886: 21. PERILLOU. Dosage rapide du carbon, du phosphore, etc.

Bull. soc. ind. mineral. (2), **13**, 108; Berg- u. hüttenm. Ztg., **45**, 6, and 32; Jsb. Chem., **1886**, 1933; Ber., **1886**, 181, Ref.; Wagner's Jsb., **32**, 11.

Volumetric method; oxidation by lead peroxide, and titration with ferrous sulphate in nitric acid solution.

1886: 22. REINHARDT, C. Gewichtsanalytische Manganbestimmung.

Chem. Ztg., **10**, 323, 357, and 372; Berg- u. hüttenm. Ztg., **45**, 163; J. Soc. Chem. Ind., **5**, 391.

Separation from iron by the basic acetate method, and precipitation by (1) a current of bromine-ammonia, or (2) bromine in hydrochloric acid, and a current of gaseous ammonia.

1886: 23. REINHARDT, C. Ueber Mangantitrationsmethoden nach N. Wolff, E. Belani, Hampe und Meineke.

Stahl. u. Eisen, **6**, 150; Wagner's Jsb., **32**, 9; Berg- u. hüttenm. Ztg., **45**, 192; J. Iron Steel Inst., **1886**, 393.

See 1884: 18; 1883: 4; 1883: 10; 1887: 17.

1886: 24. SCHÖFFEL, R., and DONATH, E. Ueber die volumetrische Bestimmung des Mangans.

Monatsh. Chem., **7**, 639; Wein. Acad. Ber. (2 Abth.), **94**, 844; Stahl u. Eisen, **7**, 30; Dingl. pol. J., **264**, 34; Berg- u. hüttenm. Ztg., **1887**, 60; Oester. Ztschr. Berg- u. Hüttenw., **35**, 70; Chem. Centrbl., **1887**, 152 and 285; Jsb. Chem., **1887**, 2429; J. Chem. Soc. (Lond.), **52**, 399; Ztg. angew. Chem., **1887**, a, 159; Chem. Ztg., **11**, 111, Rep.; Ber., **20**, 115, Ref.; Bull. soc. chim. (2), **49**, 48; Chem. Ind., **10**, 230 and 279; Wagner's Jsb., **33**, 273; J. Iron Steel Inst., **1887**, a, 468; Techn.-chem. Jahrb., **9**, 18 and 98; Chem.-techn. Rep., **26**, a, 296.

Volumetric method; addition of an excess of permanganate and titration with arsenious acid.

1886: 25. SETTERWALL, A. Om bestämmande i jern och stål m. m. af dels mangan förmedelst titrering.

Jern.-Kont. Ann., **1886**, 427; * Z. O. S. Berg. u. H. V., **25**, 410; Techn.-chem. Jahrb., **9**, 19.

Determination by oxidation with lead peroxide in nitric acid solution, and titration with arsenious oxide.

1886: 26. SPRENGER. Verfahren zur Analyse von Eisen und Stahl.

Berg- u. hüttenm. Ztg., **45**, 462.

Separation from iron by the basic acetate method, from nickel and cobalt by hydrogen sulphide, and precipitation by bromine.

1886: 27. WOLFF, N. Ueber Manganbestimmungen.

Stahl u. Eisen, **6**, 105; Wagner's Jsb., **32**, 11.

Precipitation by bromine. Also volumetric determination by titration in presence of the precipitated iron. See 1883: 22 and 1884: 18.

1886: 28. ZIMMERMANN, R. Zur N. Wolff'schen Mangantitrirung.

Stahl u. Eisen, **6**, 362; Wagner's Jsb., **32**, 11.

See 1884: 18 and 1886: 27.

1887: 1. BABBITT, H. C. Manganese in Iron and Steel.

Am. Chem. J., **9**, 58; Chem. Centrbl., **1887**, 1185; Jsb. Chem., **1887**, 2515; J. Iron Steel Inst., **1887**, b, 369; J. Chem. Soc. (Lond.), **52**, 619; Wagner's Jsb., **34**, 200.

Oxidation to permanganic acid by means of red lead, and titration with standard reducing agents.

1887: 2. BAYLEY, T. On the Separation of Zinc from Nickel and Manganese, and the Estimation of Nickel.

J. Soc. Chem. Ind., **6**, 499; Chem. Centrbl., **1887**, 1183; Chem. Ztg., **11**, 203, Rep.; Ber. **21**, 39, Ref.; J. Chem. Soc. (Lond.), **54**, 388.

Separation from zinc. Precipitation with sodium hydrogen phosphate and ammonia, addition of just enough hydrochloric acid to effect re-solution and precipitation of the zinc with hydrogen sulphide.

1887: 3. BLAIR, A. A. The Methods Employed in the Analysis of Iron Ores.

Chem. News, **56**, 197; Jsb. Chem., **1887**, 2428.

Determination as phosphate.

1887: 4. BRAND, A. Ueber eine Abänderung der titrirmetrischen Manganbestimmung durch Kaliumpermanganat.

Stahl u. Eisen, **9**, 399; Chem. Centrbl., **1887**, 876; Jsb. Chem., **1887**, 2429; Wagner's Jsb., **33**, 271; J. Iron Steel Inst., **1887**, b, 368; Berg- u. hüttenm. Ztg., **47**, 20; Techn.-chem. Jahrb., **10**, 16.

Volumetric determination by means of permanganate. Oxidation of the iron and destruction of organic matter with barium peroxide.

1887: 5. CHEEVER, B. W. Conversion of Manganese to Permanganic Acid.

J. Anal. Chem., **1**, 176.

A study of the action of lead peroxide in nitric acid solution.

1887: 6. CARNOT, A. Sur diverses réactions des vanadates et leur emploi dans l'analyse chimique.

C. R., **104**, 1803; Chem. News, **56**, 16.

Precipitation as vanadate in ammoniacal solution.

1887: 7. DONATH, E., and ZELLER, R. Einige Anwendungen des Wasserstoffsuperoxydes.

Rep. anal. Chem., **7**, 36; Jsb. Chem., **1887**, 2428; Ber., **20**, 118, Ref.; J. Anal. Chem., **1**, 321.

Separation from zinc, nickel, and cobalt by means of hydrogen peroxide.

1887: 8. HAUSHOFER. (Title unknown.)

* Jahrb. f. Min., **1**, 13; J. Chem. Soc. (Lond.), **52**, 300.

Detection by a microscopic study of the crystals formed on cooling a hot, concentrated sulphuric acid solution of the substance.

1887: 9. JOLLES, A. Ueber Kaliumpermanganat und seiner Bedeutung in der analytischen Chemie.

Schlesische Ges. vaterl. Cultur. Breslau, **65**, 150; Rep. anal. Chem., **7**, 491; Ztschr. anal. Chem., **28**, 238; Wagner's Jsb., **33**, 272; J. Chem. Soc., (Lond.) (1889), **56**, 798; Chem. Ztg., **11**, 819.

A study of the Volhard Method. (1879: 14).

1887: 10. KLOBB, T. Permanganates ammonio-cobaltiques.

Ann. chim. phys. (6), **12**, 26.

Separation from cobalt by precipitation as sulphide after the formation of cobaltic cyanide by the addition of a solution of hydrocyanic acid.

1887: 11. v. KNORRE, G. Ueber eine neue Methode zur Trennung von Eisen und Mangan.

Stahl u. Eisen, **7**, 178; Chem. Ind., **1887**, 141; Dingl. pol. J., **265**, 420; Techn.-chem. Jahrb., **9**, 18; **10**, 15.

Use of nitroso-β-napthol to separate manganese from iron or copper.

1887: 12. v. KNORRE, G. Ueber die Verwendbarkeit des Nitroso-β-napthols in der quantitativen Analyse.

Ber., **20**, 283; Ztschr. anal. Chem., **28**, 235; Chem. News, **59**, 232; J. Iron Steel Inst., **1887**, a, 470.

Separation from iron and copper.

1887: 13. LAX, E. Beiträge zur Maassanalyse des Mangans. (*Title from Berg- u. hüttenm. Ztg.*)

* Inaugur. Dissert., Berlin; Berg- u. hüttenm. Ztg., **46**, 243; Chem. Centrbl., **1887**, 970; Chem. Ztg., **11**, 514; Oester. Ztschr. Berg- u. Hüttenw., **35**, 427; Ber., **20**, 740, Ref.; Techn.-chem. Jahrb., **10**, 88.

General discussion of the Schöffel and Donath, Kessler, Hampe, Meineke and Pattinson methods. See 1883: 17; 1872: 5; 1883: 4; 1883: 10 and 1879: 9.

1887: 14. MEINEKE, C. Bestimmung des Mangans durch Fällung mittels Quecksilberoxyd und Brom.

Rep. anal. Chem., **7**, 54 and 67; Analyst, **12**, 48 and 72; Chem. Centrbl., **1887**, 554; Jsb. Chem., **1887**, 2429; J. Iron Steel Inst., **1887**, a, 469; Ztschr. angew. Chem., **1887**, 14; Chem. Ztg., **11**, 51, Rep.; Ber., **20**, 151, Ref.; J. Chem. Soc. (Lond.), **52**, 1139; Stahl u. Eisen, **7**, 287; Wagner's Jsb., **33**, 273; Berg- u. hüttenm. Ztg., **46**, 187; Techn.-chem. Jahrb., **9**, 19 and 97.

Volumetric determination. Precipitation with mercuric oxide and bromine water, solution of the precipitated peroxide in an excess of oxalic acid, and titration for this excess with permanganate.

1887: 15. MEINEKE, C. Zur Maassanalyse des Mangans.

Chem. Ztg., **11**, 137; Chem. Centrbl., **1887**, 230; J. Chem. Soc. (Lond.), **52**, 531; Berg- u. hüttenm. Ztg., **46**, 135; J. Soc. Chem. Ind., **6**, 456; Techn.-chem. Jahrb., **10**, 16.

On the cause of the incomplete precipitation obtained by the chlorate method. See also 1885: 10 and 1885: 15.

1887: 16. MORGAN, J. J. Rapid Methods for the Determination of Silicon, Sulphur, and Manganese in Iron and Steel.

* Ind. Rev.; Chem. News, **56**, 82; Chem. Centrbl., **1887**, 1268; Jsb. Chem., **1887**, 2427; Ztschr. chem. Ind., **1887**, b, 246; Chem. Ztg., **11**, 219, Rep.; J. Chem. Soc. (Lond.), **52**, 1140; Wagner's Jsb., **33**, 271; J. Anal. Chem., **1**, 418; Iron, **30**, 312; Techn.-chem. Jahrb., **10**, 16.

Colorimetric method by oxidation with lead peroxide in nitric acid solution. See also Peters, 1876: 5.

1887: 17. REINHARDT, C. Eine weitere Verbesserung der Belanischen Mangantitration.

Stahl u. Eisen, **7**, 709; Wagner's Jsb., **33**, 586; J. Iron Steel Inst., **1887**, b, 367; Techn.-chem. Jahrb., **10**, 16; Berg- u. hüttenm. Ztg., **46**, 451; Chem.-techn. Rep., **26**, b, 317.

Separation from iron by zinc oxide, precipitation by bromine in the presence of zinc oxide, solution in ferrous sulphate, and titration with potassium permanganate.

1887: 18. See 1888: 21.

1887: 19. L'ASSEMBLÉE REP. FAB. RAILS, ETC. Contributions á l'analyse chimique de fer, de l'aciers et de la fonte.

* Technik (Moscow); Monit. scientif. (4), **1**, 241; Jsb. Chem., **1887**, 2427.

Determination by the Deshayes method. See 1878: 2.

1888: 1. CAMPBELL, A. C. Separation of Ferric Iron from Cobalt, Nickel, and Manganese.

J. Anal. Chem., **2**, 291; Ztschr. anal. Chem., **30**, 616; Chem. Ztg., **12**, 250, Rep.; J. Chem. Soc. (Lond.), (1892) **62**, 103.

Separation from iron by precipitation with lead carbonate.

1888: 2. CARNOT, A. Sur l'emploi de l'eau oxygenée pour le dosage des métaux de la famille du fer.

C. R., **107**, 997 and 1150; Bull. soc. chim. (3), **1**, 279; Chem. News, **59**, 15; Jsb. Chem., **1888**, 2552; **1889**, 2395; Chem. Centrbl., **1889**, 143; Chem. Ztg., **13**, 7 and 16, Rep.; Eng. Min. J., **47**, 141; J. Soc. Chem. Ind., **8**, 216; Ztschr. anal. Chem., **29**, 336; Ztschr. angew. Chem., **1888**, 71; Ber., **22**, 111, Ref.; J. Chem. Soc. (Lond)., **56**, 443; J. Iron Steel Inst., **1889**, a, 394.

Precipitation by means of hydrogen peroxide, solution in oxalic acid, and titration with potassium permanganate.

1888: 3. FRIEDMANN, A. Zur Bestimmung des Mangans in Eisen.

Stahl u. Eisen, **8**, 315; Jsb. Chem., **1888**, 2553; Ztschr. angew. Chem., **1888**, 415; Wagner's Jsb., **34**, 196; Techn.-chem. Jahrb., **11**, 19; J. Iron and Steel Inst., **1888**, b, 328.

Decomposition by means of chlorine and final precipitation and determination as sulphide (Rose method, 1860: 5).

1888: 4. GHILIAN, A. Description et controle de la méthode volumétrique de dosage de manganèse.

Rev. univ. des mines (3), **1888**, 270; Berg- u. hüttenm. Ztg., **1888**, 454; Chem. News, **59**, 121; Jsb. Chem., **1889**, 2399; Wagner's Jsb., **34**, 200.

Separation from iron by means of ammonium carbonate, ammonium succinate, or sodium acetate, and titration with permanganate in the presence of an excess of zinc oxide.

1888: 5. DE LA HARPE, C., and RÉVERDIN, F. Petites notices analytiques.

Bull. soc. chim. (3), **1**, 164; Chem. Centrbl., **1889**, a, 391; Ber., **22**, 355, Ref.; Wagner's Jsb., **35**, 570; J. Anal. Chem., **3**, 321; J. Soc. Chem. Ind., **8**, 307.

Apparatus for the determination of peroxide by the Bunsen method. (1853: 1.)

1888: 6. ILES, M. W. Lead Slags.

Chem. News, **57**, 18; Ztschr. angew. Chem., **1888**, 197.

Determination in lead slags by the Volhard method. (1879: 14.)

1888: 7. JULIAN, F. A Method for the Determination of Manganese in Steel.

J. Anal. Chem., **2**, 249; Trans. Am. Inst. Min. Eng., **16**, 355; Chem. Centrbl., **1888**, 1400; Ztschr. anal. Chem., **32**, 370; Ztschr. angew. Chem., **1888**, 521; Chem. News, **58**, 209; Chem. Ztg., **12**, 251, Rep.; Wagner's Jsb., **34**, 193; Rev. univ. des mines, **42**, 301; Eng. Min. J., **46**, 413; J. Iron and Steel Inst., **1888**, a, 376; **1889**, a, 394; Berg- u. hüttenm. Ztg., **47**, 348; Oester. Ztschr. Berg- u. Hüttenw., **37**, 156; Techn.-chem. Jahrb., **11**, 79.

Precipitation with chlorate, solution without filtration with the aid of ferrous sulphate or oxalic acid, and titration with permanganate.

1888: 8. KLEIN, J. Ueber einige neue Reactionen.

Chem. Ztg., **12**, 1321; Berg- u. hüttenm. Ztg., **47**, 425; Arch. Pharm., **227**, 77.

Test for manganese by means of hydrogen peroxide in alkaline solution.

1888: 9. DE KONINCK, L. L., and LECRENIER, A. Bestimmung des verfügbaren Sauerstoffs in den Hyperoxyden mittels gasförmigen Salzsäure.

Ztschr. angew. Chem., **1888**, 353; Wagner's Jsb., **34**, 515; Eng. Min. J., **47**, 460; Berg- u. hüttenm. Ztg., **1888**, 295; Chem.-techn. Rep., **27**, a, 235.

Volumetric determination of peroxide depending on the evolution of chlorine gas, reaction of the latter with ferrous sulphate, and of the product with potassium iodide in excess.

1888: 10. MEINEKE, C. Studien über die Analyse von Rohstoffen und Production der Eisenindustrie.

Ztschr. angew. Chem., **1888**, 3, 219 and 252; Chem. Centrbl., **1888**, 422 and 865; Jsb. Chem., **1888**, 2550; Ztschr. anal. Chem., **36**, 700; Chem. Ztg., **12**, 29; Ber., 21, 311, Ref.; Wagner's Jsb., **34**, 198; Berg. u- hüttenm. Ztg., **47**, 81; J. Chem. Soc. (Lond.), **54**, 1132; **56**, 309; J. Iron Steel Inst., **1888**, b, 326.

Criticism of the various methods of separation from iron. Precipitation as sulphide, as carbonate, and as phosphate; separation from iron by means of nitroso-β-naphthol, barium carbonate, mercuric and zinc oxides, and by the acetate and sulphate methods.

1888: 11. MOORE, T. Methods for the Separation of Iron, Nickel, Cobalt, Manganese, Zinc, and Aluminium.

Chem. News, **57**, 125; Chem. Centrbl., **1888**, 644; Jsb. Chem., **1888**, 2553; J. Chem. Soc. (Lond.), **54**, 631; Ber., **21**, 544, Ref.; J. Anal. Chem., **2**, 309.

Separation from iron, nickel, and cobalt, by solution of the mixed carbonate precipitate with potassium cyanide, and precipitation of the manganese from this solution as sulphide, or as hydrated peroxide by means of hydrogen peroxide.

1888: 12. OETTEL, F. Ueber die Analyse des Neusilbers.

Ztschr. anal. Chem., **27**, 16; Jsb. Chem., **1888**, 2554.

Separation from iron and cobalt by electrolysis; precipitation by bromine, and determination as mangano-manganic oxide.

1888: 13. REINHARDT, C. Zur Bestimmung des Mangans in siliciumreichen aber manganarmen Roheisensorten.

Ztschr. angew. Chem., **1888**, 108; Chem. Centrbl., **1888**, 500; Jsb. Chem., **1888**, 2553; Ztschr. anal. Chem., **32**, 368; Chem. News, **58**, 171; Chem. Ztg., **12**, 66, Rep.; Chem. Ind., **11**, 186; J. Iron Steel Inst., **1888**, a. 377; b, 330; J. Chem. Soc. (Lond.), **54**, 1132; Wagner's Jsb., **34**, 197; Berg- u. hüttenm. Ztg., **47**, 221; J. Soc. Chem. Ind., **7**, 234; Analyst, **13**, 74.

Precipitation by bromine water in presence of sodium acetate and zinc oxide, re-solution in an excess of an oxalate solution, and titration for this excess with permanganate. Comments on chlorate method.

1888: 14. v. REIS, M. A. Vorschläge zur Einführung von einheitlichen analytischen Methoden für Eisenhüttenlaboratorien.

Stahl. u. Eisen, **8**, 97; Techn.-chem. Jahrb., **10**, 16.

Separation from iron by the acetate method, and determination by precipitation by bromine and ignition to mangano-manganic oxide.

1888: 15. SCHNEIDER, L. Eine neue Bestimmungsmethode des Mangans.

Wien. Akad. Ber. (2 b), **97**, 256; Monatsh. Chem., **9**, 242; Dingl. pol. J., **269**, 224; Chem. Ind., **11**, 444; J. Soc. Chem. Ind., **7**, 525 and 693; Chem. Centrbl., **1888**, 949; Jsb. Chem., **1888**, 2552; J. Chem. Soc. (Lond.), **54**, 873; Ztschr. angew. Chem. **1888**, 417; Chem. Ztg., **12**, 129, Rep.; Ber., **21**, 451, Ref.; Wagner's Jsb., **34**, 193; Berg- u. hüttenm. Ztg., **47**, 269; Arch. Pharm., **226**, 658; J. Anal. Chem., **2**, 322; Techn.-chem., Jahrb. **11**, 19; Chem. -techn. Rep., **27**, a, 234.

Determination by oxidation with bismuth tetroxide and titration with hydrogen peroxide.

1888: 16. SCHÜRMANN. Ueber die Verwandtschaft der Schwermetalle zum Schwefel.

Ann. Chem. (Liebig), **249**, 329.

Filtration of sulphides aided by a concentrated solution of sodium acetate.

1888: 17. STEIN, G. Zur Manganbestimmung in Nahrungs- und Genussmitteln.

Chem. Ztg., **12**, 446; Chem. Centrbl., **1888**, 645; J. Chem. Soc. (Lond.), **56**, 188; Chem.-techn. Rep., **27**, a, 257.

Determination in the ashes of food-stuffs by treatment with sodium nitrate, sulphuric acid, and lead peroxide, and titration for the permanganate formed with a standard ferrous salt solution. See 1888: 20.

1888: 18. THORPE, T. E., and HAMBLY, F. J. Note on Chatard's Method for the Estimation of Small Quantities of Manganese.

J. Chem. Soc. (Lond.), **53**, 182; Jsb. Chem., **1888**, 2552; Ztschr. anal. Chem., **32**, 367; Chem. Ztg., **12**, 92, Rep.; Ber., **21**, 374, Ref.; J. Iron Steel Inst., **1888**, b, 329; J. Anal. Chem., **2**, 197; Techn.-chem. Jahrb., **10**, 16; Chem. News, **57**, 48.

Oxidation with lead peroxide, and titration with ammonium oxalate. See 1871: 2.

1888: 19. THORPE, T. E., and HAMBLY, F. J. On Manganese Trioxide.

J. Chem. Soc. (Lond.), **53**, 179; Chem. Ztg., **12**, 155.

Description of Chatard's volumetric method. See 1871: 2 and 1888: 18.

1888: 20. WEISSMANN, G. Kurze Methode der Manganbestimmung im Roheisen, Stahl, etc.

Chem. Ztg., **12**, 205; Chem. Centrbl., **1888**, 423; Ber., **1888**, 311, Ref.; Ztschr. anal. Chem., **32**, 366; Chem. Ind., **11**, 212; Wagner's Jsb., **34**, 198; J. Chem. Soc. (Lond.), **54**, 992; J. Iron and Steel Inst., **1888**, a, 377; **1893**, b, 531; Berg- u. hüttenm. Ztg., **47**, 113; J. Soc. Chem. Ind., **7**, 235; Dingl. pol. J., **267**, 528; Techn.-chem. Jahrb., **10**, 17; Chem.-techn. Rep., **27**, a, 234.

Modification of the Chatard method. Oxidation to permanganic acid by lead peroxide and titration with ferrous ammonium sulphate. See 1871: 2 and 1888: 17.

1888: 21. ——. Analytical Chemistry as Applied to the Manufacture of Iron and Steel.

Iron, **30**, 360 and 504; Stahl und Eisen, **8**, 607; Wagner's Jsb., **35**, 173.

Separation from iron by the acetate method, precipitation by bromine, and determination as mangano-manganic oxide, as manganous sulphate, or by difference after determination of the iron.

1889: 1. ALT, H. Zur Fällung von Mangan als Hyperoxyd.

Chem. Ztg., **13**, 1339; Chem. Centrbl. **1889**, b, 859; Jsb. Chem., **1889**, 2399; J. Chem. Soc. (Lond.), **58**, 419; Stahl u. Eisen, **9**, 961; Berg- u. hüttenm. Ztg. **48**, 429; J. Anal. Chem., **3**, 425; Techn.-chem. Jahrb., **12**, 13.

Adhesion of precipitate to glass said to be prevented by boiling the solution to expel air.

1889: 2. BLUM, L. Eine Fehlerquelle bei der Trennung geringer Manganmengen von viel Kalk durch Schwefelammonium.

Ztschr. anal. Chem., **28**, 454; Chem. Centrbl., **1889**, b, 513; J. Chem. Soc. (Lond.), **56**, 1087; Ber., **22**, 706, Ref.; Chem. Ind., **13**, 89; Stahl u. Eisen, **9**, 960; School Mines Quart., **11**, 69; J. Iron Steel Inst., **1890**, a, 372; J. Soc. Chem. Ind., **8**, 922; Analyst, **14**, 192.

Separation from calcium by means of ammonium sulphide.

1889: 3. BRAND, A. Ueber die Anwendung von pyrophosphorsauren Doppelsalzen zur Bestimmung und Trennung von Metallen durch Electrolyse.

Ztschr. anal. Chem., **28**, 586, 599, and 604; Chem. Centrbl., **1890**, a, 140; Chem. Ind., **13**, 90; J. Chem. Soc. (Lond.), **58**, 294.

Electrolytic determination, and separation from nickel, cobalt, copper, cadmium, zinc, mercury, and iron.

1889: 4. FINKENER. Zur Bestimmung des wirksamen Sauerstoffs.

Mitthl. Vers. Berlin, **1889**, 158; Jsb. Chem., **1890**, 2444; Dingl. pol. J., **276**, 479; Ztschr. angew. Chem., **1890**, 271.

Comments on Bunsen, ferrous sulphate, and oxalic acid (volumetric) methods, for the determination of peroxide.

1889: 5. FRIEDBURG, L. H. Notes on Quantitative Analysis.

Chem. News, **62**, 23; Jsb. Chem., **1890**, 2379.

Determination in silicates.

1889: 5a. GOOCH, F. A. and WHITFIELD, J. E. Analyses of Waters of the Yellowstone National Park.

Bull. U. S. Geol. Surv., **No. 47**, 27.

Determination in mineral waters.

1889: 6. KLEIN, J. Ueber die Empfindlichkeit des Mangannachweises mittels Wasserstoffsuperoxyd.

Arch. Pharm. (3), **27**, 77; Chem. Centrbl., **1889**, a, 391; Jsb. Chem., **1889**, 2398; Chem. Ztg., **13**, 83, Rep.; Ber., **22**, 171, Ref.; J. Chem. Soc., **56**, 653; Berg- u. hüttenm. Ztg., **48**, 164; Chem. -techn. Rep., **28**, a, 240.

Detection, in presence of cobalt, by means of hydrogen peroxide.

1889: 7. KOHN, C. J., and WOODGATE, J. The Application of Electrolysis to Quantitative Analysis.

J. Soc. Chem. Ind., **8**, 256; Chem. Centrbl., **1889**, b, 54; Jsb. Chem., **1889**, 2304.

Electrolytic separation from iron.

1889: 8. DE KONINCK, L. L. Zur Prüfung der Reagentien.

Ztschr. angew. Chem., **1889**, 4; Jsb. Chem., **1889**, 2299; Rev. univers. des mines, **1889**, 308; Berg- u. hüttenm. Ztg., **48**, 183; Chem. News, **59**, 230.

Detection of manganese in lead peroxide by decomposition with hot, concentrated sulphuric acid, and the addition of more lead peroxide to form permanganic acid.

1889: 9. MAYER, F. Zur qualitative Analyse des Schwefelammoniumniederschlags.

Ber., **22**, 2627; Jsb. Chem., **1889**, 2391.

Separation from iron and aluminum by the acetate method.

1889: 10. M'KELLAR, W. G. A Convenient Solution for Use in Titrating Weldon Muds for Manganese Peroxide.

J. Soc. Chem. Ind., **8**, 968; Jsb. Chem., **1889**, 2399; J. Chem. Soc. (Lond.), **58**, 548.

Determination of peroxides by use of standard solutions of bichromate and ferrous sulphate.

1889: 11. MCCULLOCH, N. The Volumetric Estimation of Cobalt in Presence of Nickel, Manganese, and other Metals.

Chem. News, **59**, 51; Chem.-techn. Rep., **29**, 240; Chem. Ztg., **13**, 38, Rep.

Separation from cobalt by the use of sodium acetate and potassium cyanide.

1889: 12. MCCULLOCH, N. The Use of Peroxide of Hydrogen for the Determination of the Metals of the Iron Group.

Chem. News, **59**, 35; Jsb. Chem., **1889**, 2395; Chem. Ztg., **13**, 26, Rep.

Criticism of Carnot's article on the action of hydrogen peroxide on the salts of manganese.

1889: 13. MOLDENHAUER, F. Kupfervitriol als Indikator beim Titriren von Zink und Manganese.

Chem. Ztg., **13**, 1220; Chem. Centrbl., **1889**, 811; Jsb. Chem., **1889**, 2407; Ztschr. anal. Chem., **30**, 340; Ber., **22**, 711, Ref.; J. Soc. Chem. Ind., **9**, 108; J. Anal. Chem., **3**, 429.

Volumetric determination in presence of zinc, by the use of ferrocyanide.

1889: 14. NEUMANN, G. Quantitative Bestimmung von Zink neben Mangan.

Ztschr. anal. Chem., **28**, 57; Jsb. Chem., **1889**, 2408; J. Chem. Soc. (Lond.), **56**, 549; J. Soc. Chem. Ind., **8**, 62; J. Anal. Chem., **4**, 69; Chem. Ztg., **23**, 38, Rep.

Separation of zinc as sulphide from a formic acid solution.

1889: 15. RADAU, C. Zur Kenntniss vanadinsaurer Salze.

Ann. Chem. (Liebig), **251**, 154.

Separation from vanadium by fusion with sodium carbonate, solution of the fused mass in water, precipitation of hydrated manganese peroxide with alcohol, re-solution in hydrochloric acid, and re-precipitation with hydrogen peroxide and ammonia.

1889: 16. REITMAIR, O. Kalkbestimmung bei Gegenwart von Phosphorsäure, Eisen, Thonerde und Mangan.

Ztschr. angew. Chem., **1889**, 358; Ztschr. anal. Chem., **31**, 314.

Separation from calcium by means of oxalates.

1889: 17. SCHNEIDER, L. Eine neue Bestimmungsmethode des Mangans.

Oester. Ztschr. Berg- u. Hüttenw., **36**, 608; Chem. Centrbl., **1889**, a, 64; Berg- u. hüttenm. Ztg., **48**, 153; Chem.-techn. Centrl. Anz., **1889**, 64; Pharm. Centrh., **30**, 189; Chem.-techn. Rep. **28**, a, 240.

Oxidation by bismuth tetroxide and titration with hydrogen peroxide

1889: 18. SMITH, E. F. and FRÄNKEL, L. K. Electrolytic Separations.

Chem. News, **60**, 102 and 262; Jsb. Chem., **1889**, 2305; Chem. Ztg., **13**, 257, Rep.; J. Anal. Chem., **3**, 386.

Electrolytic determination in the presence of potassium sulphocyanate.

1889: 19. WELLS, J. S. C. and VULTÉ, H. T. A Scheme for the Separation of Al, Cr, Fe, Co, Ni, Mn, Zn, Ba, Ca, Sr, and Mg, in the Presence of Phosphoric, Arsenic, Oxalic, Boric, Silicic, Hydrofluoric, Acetic, and Tartaric Acids, and Organic Matter.

School Mines Quart., **10**, 3; Analyst, **14**, 1888; Ztschr. angew. Chem., **1889**, 681.

Qualitative separation from zinc as sulphide, and detection in the mixed sulphides by fusion with sodium carbonate.

1890: 1. BAUMANN, A. Die Analyse des Braunsteins mittels Wasserstoffsuperoxyd.

Ztschr. angew. Chem., **1890**, 72; Jsb. Chem., **1890**, 2442; Chem. News, **63**, 72; Monit. scientif., **35**, 596.

Comments on the Lunge method and also on the Fresenius–Will method. Determination of peroxide by volumetric and gasometric methods. See 1885: 13; 1890: 9; 1890: 10; and 1843: 3.

1890: 2. VAN BEMMELN, J. M. Ueber die Bestimmung des Wassers, des Humus, des Schwefels, des in colloidalen Silicaten gebundenen Kieselsäure, des Mangans, u. s. w. im Ackerboden.

Landw. Vers. Stat., **37**, 289; Jsb. Chem., **1890**, 2557; J. Chem. Soc. (Lond.), **58**, 833.
Determination in soils. Carnot method. See 1888: 2.

1890: 3. BOYD, R. C. The Determination of Manganese and Zinc as Pyrophosphates.

School Mines Quart., **11**, 355; Jsb. Chem., **1890**, 2442; J. Soc. Chem. Ind., **9**, 973.
See title.

1890: 4. CARNOT, A. (Discussion.)

Bull. soc. chim. (3), **3**, 594; Chem. Ztg., **14**, 637; Oester. Ztschr. Berg- u. Hüttenw., **38**, 450.
Precipitation by means of hydrogen peroxide.

1890: 5. FRESENIUS, R. and HINTZ, E. Ueber die Analyse von Chromeisen.

Ztschr. anal. Chem., **29**, 28; Jsb. Chem., **1890**, 2440.
Determination in chromite.

1890: 6. HELLMAN, C. G. Determination of Manganese in Iron.

Eng. Min. J., **50**, 593.
Recommends method of Särnström. See 1881: 15.

1890: 7. JENSCH, E. Zur Bestimmung des Zinks in manganhaltigem Flugstaube.

Chem. Ztg., **13**, 465, 726; J. Chem. Soc. (Lond.), **58**, 294.
Separation from zinc by means of hydrogen peroxide.

1890: 8. DE KONINCK, L. L. Études sur les procédés d'analyse des matières premières et des produits de la sidérurgie.

Rev. univers. des mines, **9**, 243; Jsb. Chem., **1890**, 2436; Chem. News, **62**, 19; J. Anal. Chem., **4**, 335.
Separation from iron by means of nitroso-β naphthol.

1890: 9. LUNGE, G. Ueber die Werthbestimmung des Chorkalks, Braunsteins und Chamäleons auf gasvolumetrischem Wege (mittels des Nitrometers).

Ztschr. angew. Chem., **1890**, 10; J. Soc. Chem. Ind., **9**, 21; Jsb. Chem., **1890**, 2389; Chem. Ind., **13**, 88; Ztschr. anal. Chem., **30**, 221; Wagner's Jsb., **36**, 560; J. Chem. Soc. (Lond.), **58**, 1470.
Determination of peroxide by means of hydrogen peroxide.

1890: 10. LUNGE, G. Zur gasvolumetrischen Analyse durch Wasserstoffsuperoxyd.

Ztschr. angew. Chem., **1890**, 136; Jsb. Chem., **1890**, 2444.
Reply to Baumann's criticisms. See 1890: 1.

1890: 11. LUNGE, G. Das Gasvolumeter, ein Apparat zur volligen Ersparung aller Reductionrechnungen bri Ablesungen von Gasvolumen.

Ztschr. angew. Chem., **1890**, 139; Ber., **23**, 440; Ztschr. anal. Chem., **29**, 589.

A modification of the nitrometer. (See 1890: 9.)

1890: 12. MCKENNA, A. G. The Precipitation of Manganese as Ammonium Manganous Phosphate.

Tech. Quart., **3**, 333; Chem. News, **63**, 184; J. Anal. Chem., **5**, 140; Iron, **37**, 469; Jsb. Chem., **1891**, 2479; J. Chem. Soc. (Lond.) **61**, 1138; J. Iron Steel Inst., **1891**, b, 326; School Mines Quart., **12**, 262; Berg- u. hüttenm. Ztg., **50**, 186; Eng. Min. J., **51**, 635; J. Soc. Chem. Ind., **10**, 387; Chem.-techn. Rep., **31**, c, 268.

A study of Gibbs method (1867: 3). Comments on Blair method. (1887: 3.)

1890: 13. MYHLERTZ, F. G. Method for the Rapid Determination of Manganese in Slags, Ores, etc.

J. Anal. Chem., **4**, 267; Chem. Centrbl., **1890**, b, 607; Ztschr. anal. Chem., **32**, 368; Chem. Ztg., **14**, 251, Rep.; Wagner's Jsb., **36**, 337; J. Chem. Soc. (Lond.), **60**, 366; School Mines Quart., **12**, 61; Berg- u. hüttenm. Ztg., **49**, 400; Oester. Ztschr. Berg- u. Hüttenw., **39**, 13; J. Iron Steel Inst., **1891**, a, 444; Techn.-chem. Jahrb., **13**, 75.

Fusion with carbonate and nitrate, reduction of manganate with alcohol, solution of precipitate in ferrous sulphate solution, and titration of excess of latter.

1890: 14. RIBAN, J. Sur le dosage et la séparation du zinc en présence du fer et du manganèse.

C. R., **110**, 1196; Bull. soc. chim. (3), **4**, 116; Jsb. Chem., **1890**, 2449; Chem. Centrbl., **1890**, b, 120.

Separation from zinc by precipitation with sulphuretted hydrogen in feebly acid solution.

1890: 15. SELLIK, B. Technische Analyse des Wolframits.

Chem. Ztg., **13**, 1474; Ztschr. anal. Chem., **29**, 105.

Determination in wolframite.

1890: 16. VORTMANN, G. Eine neue Methode zur maassanalytische Bestimmung des Mangans.

Ber., **23**, 2801; Jsb. Chem., **1890**, 2441; Chem. Centrbl., **1890**, b, 676; Ztschr. angew. Chem., **1890**, 715; Chem. Ztg., **14**, 289, Rep.; J. Chem. Soc. (Lond.), **58**, 1470; Chem. News, **62**, 251; Bull. soc. chim. (3), **4**, 854; Chem. Ind., **14**, 214; Wagner's Jsb., **36**, 336; J. Iron Steel Inst., **1891**, a, 440; School Mines Quart., **12**, 61; Oester. Ztschr. Berg- u. Hüttenw., **39**, 14; J. Soc. Chem. Ind., **9**, 1067; J. Anal. Chem., **4**, 57; Chem.-techn. Rep., **30**, b, 179.

Precipitation, after the addition of ferric salt, by means of sodium hydroxide and a standard iodine solution; filtration, and determination of the iodine in a measured volume of the filtrate.

1890: 17. WARREN, H. N. A Brief Summary of Practical Manipulation.

Chem. News, **61**, 63; Ztschr. anal. Chem., **30**, 35; Jsb. Chem., **1890**, 2372.
Use of powdered glass to promote settling of the basic ferric-acetate precipitate.

1890: 18. ZIEGLER, A. Ueber die analytische Bestimmung der wesentlichen Bestandtheile des metallischen Wolframs, Ferro-Wolframs und Wolframstahles; sowie des Ferrochroms und Chromstahles, unter theilweiser Zugrundelegung neuer Aufschlussverfahren.

Dingl. pol. J., **274**, 517; **275**, 91; Monit. scientif. (4), **4**, 486; Jsb. Chem., **1890**, 2455; Ztschr. anal. Chem., **30**, 47.
Determination in tungsten alloys.

1891: 1. BEHRENS, H. Beiträge zur michrochemischen Analyse.

Ztschr. anal. Chem., **30**, 140.
Detection by microchemical tests with oxalic acid, salt of phosphorus, and potassium chlorate.

1891: 2. BLUM, L. Zur Bestimmung des Mangans im Eisen und Stahl.

Ztschr. anal. Chem., **30**, 210; Jsb. Chem., **1891**, 2482; Chem. Centrbl., **1891**, a, 810; J. Chem. Soc. (Lond.), **61**, 963; Chem. Ind., **14**, 498; Berg- u. hüttenm. Ztg., **50**, 211; School Mines Quart., **12**, 335; Chem. News, **63**, 204.
Comments on the Volhard method and the Rürup modification of the same (1891: 26).

1891: 3. BLUM, L. Ueber eine neue Methode zur volumetrischen Bestimmung des Mangans.

Ztschr. anal. Chem., **30**, 284; Jsb. Chem., **1891**, 2480; J. Chem. Soc. (Lond.), **61**, 1293; J. Iron Steel Inst., **1891**, b, 330; Chem. Ztg., **15**, 207, Rep.; Ber., **24**, 841, Ref.; Techn.-chem. Jahrb., **14**, 34; School Mines Quart., **12**, 335; Berg- u. hüttenm. Ztg., **50**, 276; **51**, 41; Eng. Min. J., **53**, 88; J. Soc. Chem. Ind., **10**, 798; Analyst, **16**, 140; Chem.-techn. Rep., **31**, c, 267.
Titration with potassium ferrocyanide in the presence of ammonium tartrate, ferric salts, ammonium chloride, and free ammonia.

1891: 4. BROWN, D. H. Hints for Beginners in Iron Analysis.

J. Anal. Chem., **5**, 368 and 374.

Comments on the Volhard (1879: 14) and Williams (1881: 18) methods of determination.

1891: 5. CHEMIKER COMMISSION DER VEREIN DEUTSCHER EISENHÜTTENLEUTE. Manganbestimmung: Bericht über die bisherigen Arbeiten der vom Verein deutscher Eisenhüttenleute eingesetzten Commission zur Einführung einheitlicher Untersuchungsmethoden.

Stahl u. Eisen, **11**, 373; Chem. Centrbl., **1891**, a, 1003; J. Iron Steel Inst., **1891**, a, 437.

Discussion of permanganate and chlorate methods. (Wolff, Hampe, Meineke, Reinhardt, Schoeffel and Donath, Ukena.)

1891: 6. DONATH, E. Zur analytischen Anwendung von Baryum- und Wasserstoffsuperoxyd.

Chem. Ztg., **15**, 1085; Jsb. Chem., **1891**, 2393; Chem. Ind., **15**, 189.

Precipitation by means of hydrogen peroxide. Question of priority. See 1891: 11.

1891: 7. DONATH, E. Ueber eine "neue" Mangan und Zinktrennung von P. Jannasch und MacGregory.

Ber., **24**, 3600; Jsb. Chem., **1891**, 2484; J. Chem. Soc. (Lond.), **62**, 384; Bull. soc. chim. (3), **8**, 524.

Question of priority. See 1891: 11.

1891: 8. HAMPE, W. Zur volumetrischen Bestimmung des Mangans.

Chem. Ztg., **15**, 281.

Criticism of Moore's statements (1891: 18) regarding the conversion of manganese to phosphate and titration with a ferrous salt.

1891: 9. HAMPE, W. Ueber Bestimmung des Mangans nach der Chloratmethode.

Chem. Ztg., **15**, 1579; Jsb. Chem., **1891**, 2481; Chem. Centrbl., **1892**, a, 182; J. Chem. Soc. (Lond.), **62**, 1132.

Criticises report of the Chemiker-Commission, 1891: 5.

1891: 10. JANNASCH, P. and FRANZEK, C. J. Ueber eine neue quantitative Trennung von Mangan und Nickel, Mangan und Kobalt, und von Mangan, Nickel und Kobalt.

Ber., **24**, 3204; Jsb. Chem., **1891**, 2484; Chem. Centrbl., **1892**, a, 182; J. Iron Steel Inst., **1892**, a, 493; Chem. News., **64**, 294; Chem. Ztg., **15**, 306, Rep.; Bull. soc. chim. (3), **8**, 277; J. Chem. Soc. (Lond.), **62**, 240; Chem. Ind., **15**, 213; School Mines Quart., **13**, 177; J. Soc. Chem. Ind., **10**, 1037; Analyst, **17**, 58; Chem. -techn. Rep., **31**, b. 297.

Separations as in title by means of hydrogen peroxide in cyanide solution.

1891: 11. JANNASCH, P., and MACGREGORY, J. F. Ueber eine neue quantitative Trennung von Mangan und Zink.

J. prakt. chem. (2), **43**, 402; Chem. Centrbl., **1891**, a, 1002; J. Chem. Soc. (Lond.), **61**, 963; Chem. News, **63**, 255; **64**, 182; Ztschr. anal. chem., **31**, 69; Chem. Ztg., **15**, 142, Rep.; Ber. **24**, 675, Ref.; School Mines Quart., **12**, 337; **13**, 75; Eng. Min. J., **52**, 386; J. Soc. Chem. Ind., **10**, 659; J. Anal. Chem., **5**, 659.

Separation by means of hydrogen peroxide.

1891: 12. JANNASCH, P., and NIEDERHOFHEIM. Ueber quantitative Metall-scheidungen in alkalischer Lösung durch Wasserstoffsuperoxyd.

Ber., **24**, 3945; Jsb. Chem., **1891**, 2484; Chem. News, **65**, 159; Ztschr. angew. Chem., **1892**, 83; Chem. Ztg., **16**, 13, Rep.; Chem. Ind., **15**, 213; Iron, **39**, 337.

Separation from zinc by the use of hydrogen peroxide in cyanide solution.

1891: 13. LUCKOW, C. Verfahren zur leichten electrolytischen Ausfällung verschiedenen Metalle aus sauren Lösungen.

Chem. Ztg., **15**, 740; Jsb. Chem., **1891**, 2402.

Electrolytic precipitation upon mercury with formation of an amalgam.

1891: 14. LUCKOW, C. Ueber maassanalytische Bestimmungs- und analytische Trennungsmethoden mit Ferro- und Ferricyankalium.

Chem. Ztg., **15**, 1491; Chem. Centrbl., **1892**, a, 180.

Volumetric determination by means of potassium ferrocyanide.

1891: 15. LE ROY, G. A. Sur un nouveau mode de séparation du fer d'avec le cobalt et le nickel.

C. R., **112**, 722; Ber., **24**, 406, Ref.

Electrolytic precipitation.

1891: 16. MOLDENHAUER, F. Abänderung der Manganprobe nach Volhard.

Chem. Ztg., **15**, 13; Jsb. Chem., **1891**, 2481; Chem. Centrbl., **1891**, a, 283; Stahl u. Eisen, **11**, 151; Berg. u. hüttenm. Ztg., **50**, 75; Chem.-techn. Rep., **31**, c, 268.

Modification consists of adding ammonium sulphate, and titrating in the presence of the iron precipitate.

1891: 17. MOLDENHAUER, F. Ueber Fehlerquellen beim Titriren des Zinks mit Ferrocyankalium und deren Vermeidung.

Chem. Ztg., **15**, 223; Ztschr. anal. chem., **30**, 340.

Volumetric determination by means of potassium ferrocyanide.

1891: 18. MOORE, T. Volumetric Estimation of Manganese.

Chem. News, **63**, 66; Eng. Min. J., **51**, 234; Jsb. Chem., **1891**, 2479; Chem. Centrbl., **1891**, a, 554; J.Chem. Soc. (Lond.), **61**, 962; Ztschr. angew. Chem., **1891**, 523; Chem. Ztg., **15**, 33, Rep.; Ber., **24**, 407, Ref.; Bull. soc. chim. (3), **6**, 621; Chem. Ind., **14**, 498; Wagner's Jsb., **37**, 209; Berg- u. hüttenm. Ztg., **50**, 185; J. Anal. chem., **5**, 237; Chem.-techn. Rep., **31**, a, 267.

Volumetric determination by forming manganic metaphosphate, and titrating directly for this compound, with a reducing agent.

1891: 19. NORRIS, G. L. Determination of Manganese in Manganiferous Slags and Ores.

J. Anal. Chem., **5**, 430; Chem. News, **64**, 242; Jsb. Chem., **1891**, 2482; Chem. Centrbl., **1892**, a, 181; Chem. Ztg., **15**, 271, Rep.; Bull. soc. chim. (3), **8**, 539; Ztschr. angew. Chem., **1891**, 650; J. Iron Steel Inst., **1891**, b, 330; J. Chem. Soc. (Lond.), **62**, 385; Wagner's Jsb., **37**, 209; Berg- u. hüttenm, Ztg., **51**, 41; Iron, **38**, 449; Chem.-techn. Rep., **31**, b. 297; Deutsche chem. Ztg., **1891**, 409.

Solution in nitric and hydrofluoric acids, precipitation by potassium chlorate, re-solution of precipitate in oxalic acid or ferrous sulphate solution, and titration for the excess of the reducing agent.

1891: 20. NAMIAS, R. Methode zur schnellen Ausführung von Schlacken-Analysen.

Stahl u. Eisen, **11**, 579; Jsb. Chem., **1891**, 2461; Chem. Centrbl., **1891**, b, 493.

Use of Volhard method of determination (1879: 14).

1891: 21. PATTINSON, J. and H. S. On the Determination of Manganese in its Ores and Alloys.

J. Soc. Chem. Ind., **10**, 333; Jsb. Chem., **1891**, 2483; Chem. Centrbl., **1891**, a, 1091; J. Chem. Soc. (Lond.), **62**, 536; Ztschr. angew. Chem., **1891**, 380; Chem. Ind., **14**, 498; Wagner's Jsb., **37**, 140; School Mines Quart., **12**, 335.

Gravimetric and volumetric methods. A study of the ignition of maganese carbonate and of the hydrated peroxide, with reference to gravimetric determinations. Comments on volumetric methods in use at present and a modified form of the Pattinson method. See 1879: 9.

1891: 22. REGELSBERGER, F. Zur Werthbestimmung des Aluminiums und seiner Legirungen.

Ztschr. angew. Chem., **1891**, 476.

Determination in commercial aluminum.

1891: 23. v. REIS, M. A. Ueber Bestimmung von Mangan nach der Chloratmethode.

Chem. Ztg., **15**, 1791; Chem. Centrbl., **1892**, a, 412; Stahl u. Eisen, **1891**, 375; Ztschr. angew. Chem., **1891**, 377; J. Iron Steel Inst., **1892**, a, 490.

Criticism of Hampe's method of determination by means of potassium chlorate (1883: 4).

1891: 24. ROSSI, A. J. On Some Methods of Analysis of Iron, Steel, and Cast Iron as Practised in Large Industrial Works.

Iron Age, **47**, 528; J. Iron Steel Inst., **1891**, a, 443; **1892**, a, 491; Stahl u. Eisen, **11**, 927; Wagner's Jsb., **37**, 147.

Colorimetric determination with the use of sodium metaphosphate.

1891: 25. RUBRICIUS, H. Zur Bestimmung von Mangan in Eisen und Stahl.

Chem. Ztg., **15**, 882; Jsb. Chem., **1891**, 2481; Chem. Centrbl., **1891**, b, 281; J. Chem. Soc. (Lond.), **62**, 1030; Wagner's Jsb., **37**, 146; Chem.-techn. Rep., **31**, b, 297; Berg- u. hüttenm. Ztg., **50**, 390; Analyst, **16**, 180.

Modification of the Volhard method. Comments on Rürup procedure. See 1879: 14 and 1891: 26.

1891: 26. RÜRUP, L. Manganbestimmung in Eisen und Stahl.

Chem. Ztg., **15**, 149 and 186; Jsb. Chem., **1891**, 2481; Chem. Centrbl., **1891**, a, 470; J. Chem. Soc. (Lond.), **62**, 916; Ztschr. anal. Chem., **30**, 242; Wagner's Jsb., **37**, 140; J. Iron Steel Inst., **1891**, b, 326.

Modification of Volhard procedure. Addition of sodium sulphate, and titration without filtration. See 1891: 25.

1891: 27. SMITH, E. F. The Electrolysis of Metallic Phosphates in Acid Solution.

Am. Chem. J., **13**, 206; Jsb. Chem., **1891**, 2400.

Electrolytic separation from cadmium.

1891: 28. UKENA. Modificierte Chloratmethode.

Stahl u. Eisen, **11**, 381.

Precipitation by means of potassium chlorate and solution in reducing agent.

1892: 1. ALLER. Quick Assay Methods.

Iron, **40**, 382; Berg- u. hüttenm. Ztg., **52**, 106; Chem. Centrbl., **1893**, a, 858.

Determination by Volhard procedure. See 1879: 14.

1892: 2. BASTIN, C. Dosage du manganèse dans les spiegels et les ferro-manganèses.

Monit. scientif. (4), **6**, 639; Chem. Centrbl., **1892**, b, 632; Ztschr. angew. Chem., **1892**, 704; Wagner's Jsb., **38**, 118; J. Iron Steel Inst., **1893**, a, 403; Berg- u. hüttenm. Ztg., **52**, 59; J. Soc. Chem. Ind., **11**, 1037.

Determination by Williams procedure. See 1881: 18.

1892: 3. BLUM, L. Zur volumetrischen Bestimmung des Zinks.

Ztschr. anal. Chem., **31**, 60; Berg- u. hüttenm. Ztg., **51**, 164.
Separation from zinc by means of bromine in alkaline solution.

1892: 4. CAMPREDON. Dosage du manganèse dans les produits sidérurgiques.

Rev. chim. indust., **3**, 298.
Separation from iron by the acetate method, and volumetric determination by means of potassium permanganate.

1892: 5. CHEMIKER COMMISSION. Manganbestimmung: Erwiderung der Chemiker Commission des Vereins deutscher Eisenhüttenleute auf die Angriffe des Professors Hampe.

Stahl u. Eisen, **12**, 290; Chem. Centrbl., **1892**, a, 604; J. Iron Steel Inst., **1892**, a, 489; Ztschr., angew. Chem., **1892**, 275; Wagner's Jsb., **38**, 120.
Reply to Hampe, 1892: 9.

1892: 6. DENIGES. Natriumhypobromitlösung als Reagens auf Mangan. (*Title from Ztschr. anal. Chem.*)

* Deutsche-Amerikan. Apotheker Ztg., **11**, 75; Ztschr. anal. Chem., **31**, 316.
Detection by means of sodium hypobromite.

1892: 7. DONATH, E. Bemerkungen zur Vereinbarung einheitlicher Untersuchungsmethoden für Eisen und Stahl.

Chem. Ztg., **16**, 141.
Criticism of report of Chemiker-Commission. See 1891: 5 and 1892: 5.

1892: 8. FREY. Zur mikrochemischen Gesteinsanalyse. (*Title from Pharm. Centrh.*)

Schweiz. Wochenschr. Pharm., **30**, 149; Pharm. Centrh. (N. F.), **13**, 266; Ztschr. anal. Chem., **32**, 204.
Detection by means of microchemical tests.

1892: 9. HAMPE, W. Nochmals die Chloratmethode.

Chem. Ztg., **16**, 13; Chem. Centrbl., **1892**, a, 457; Ztschr. anorg. Chem., **1**, 389.
Criticism of the report of the Chemiker-Commission. See 1892: 5 and 1892: 7.

1892: 10. MOORE, T. The Determination of Cobalt in Manganese Ores, and a quick Method for its Estimation.

Chem. News, **65**, 75; **66**, 11; Ztschr. anorg. Chem. **1**, 392; Ber., **25**, 444, Ref.
Separation from cobalt with the aid of citric acid.

892: 11. PRIWOZNIK. Mittheilungen über die im Laboratorium des K. K. General-Probieramtes in Wien in den Jahren 1890 und 1891 ausgeführten Analysen und anderweitigen Untersuchungen.

Berg- u. hüttenm. Jahrb., **40**, 475; Ztschr. angew. Chem., **1893**, 180; Wagner's Jsb., **38**, 216.

Separation from iron by the acetate method.

892: 12. v. REIS, M. A. Zur Bestimmung von Mangan im Eisen.

Ztschr. anal. Chem., **31**, 604 and 672; Chem. Centrbl., **1892**, b, 940; **1893**, a, 133; J. Chem. Soc. (Lond.), **64**, b, 304; Ztschr. anorg. Chem., **3**, 337; Wagner's Jsb., **38**, 121; School Mines Quart., **14**, 159; Berg- u. hüttenm. Ztg., **52**, 107; J. Soc., Chem. Ind., **12**, 378; Dingl. pol. J., **289**, 214.

Oxidation of organic matter by the use of barium peroxide. Volumetric determination by the Volhard procedure. See 1887: 4 and 1879: 14.

892: 13. v. REIS, M. A. Ueber Bestimmung des Mangans nach der Chloratmethode.

Chem. Ztg., **15**, 1791; Stahl u. Eisen, **12**, 28; J. Chem. Soc. (Lond.), **62**, 1132.

Comments on Hampe's article. See 1892: 9.

892: 14. RIGGS, R. B. The Separation of Iron, Manganese, and Calcium by the Acetate and Bromine Methods.

Am. J. Sci. (3), **43**, 135; J. Anal. Chem., **6**, 94; Chem. Centrbl., **1892**, a, 1004; Ztschr. anorg. Chem., **3**, 235; J. Iron Steel Inst., **1893**, a, 403; Stahl u. Eisen, **13**, 119; J. Chem. Soc. (Lond.), **62**, 916; School Mines Quart., **13**, 286; J. Soc. Chem. Ind., **12**, 183.

Separation from iron and calcium as in title.

892: 15. ROTHE, J. W. Trennung des Eisens von anderen Elementen nach einem neuen Verfahren.

Mitth. Kgl. Verst. zu Berlin, **10**, 132; Iron, **40**, 404; J. Iron Steel Inst., **1892**, b, 510.

Separation from iron by extraction with ether.

892: 16. RUBRICIUS, H. Nachtrag zur modificierten Volhard-'schen Manganprobe.

Chem. Ztg., **16**, 459; Oester. Ztschr. Berg- u. Hüttenw., **40**, 146; Chem. Centrbl., **1892**, a, 829; J. Iron Steel Inst., **1892**, b, 512; Ztschr. angew. Chem., **1892**, 274; Wagner's Jsb., **38**, 118; J. Chem. Soc. (Lond.), **62**, 1524; Dingl. pol. J., **285**, 286.

Experimental data to show accuracy of Volhard procedure (1879: 14).

892: 17. RUBRICIUS, H. Manganbestimmung, mit specieller Berücksichtigung der verschiedenen Eisensorten.

Chem. Ztg., **16**, 209; Chem. Centrbl., **1892**, a, 507; Berg- u. hüttenm. Ztg., **51**, 163.

Determination in irons by the Volhard procedure (1879: 14).

1892: 18. RÜDORFF, F. Quantitative Analyse durch Elektrolyse.

Ztschr. angew. Chem., **1892,** 6; Chem. Centrbl., **1892,** a, 331; J. Chem. Soc. (Lond.), **64,** b, 94.

Determination by electrolysis.

1892: 19. SCHNEIDER, L. Beiträge zur chemischen Untersuchung des Stahles.

Oester. Ztschr. Berg- u. Hüttenw., **40,** 46 and 235; Chem. Centrbl., **1892,** a, 337; Ztschr. angew. Chem., **1892,** 274 and 466; School Mines Quart., **14,** 362; Stahl u. Eisen, **12,** 471; Wagner's Jsb., **38,** 119; Berg- u. hüttenm. Ztg., **51,** 163; Ztschr. anorg. Chem., **1,** 474; J. Iron Steel Inst., **1892,** b, 512; J. Soc. Chem. Ind. **12,** 293; **13,** 546; Dingl. pol. J., **291,** 238.

Determination in steel by oxidation to permanganic acid by means of lead peroxide and titration with hydrogen peroxide. Determination in chrome steel.

1892: 20. VAN GRUNDY, C. P. Note on Textor's Rapid Method for the Determination of Manganese.

Proc. Eng. Soc. Western Penna., **8,** 158; J. Iron Steel Inst., **1892,** b, 512.

Oxidation to permanganic acid by means of lead peroxide, and titration with arsenious acid. (Description of Textor procedure is given in this article. No other description has been found.)

1892: 21. WARWICK, H. S. Die Elektrolyse von Metall-formiaten.

Ztschr. anorg. Chem., **1,** 298 and 299.

Electrolytic determination and separation from zinc and cadmium.

1893: 1. CARNOT, A. (Discussion.)

Bull. soc. chim. (3), **9,** 214; Chem. Centrbl., **1893,** b, 156; Chem. News, **68,** 15 and 301.

Comments on the paper by Gorgeu, 1893: 6.

1893: 2. CARNOT, A. Sur la precipitation du manganèse par l'eau oxygenée et l'ammoniaque, en vue de son dosage pondéral ou volumétrique.

Bull. soc. chim. (3), **9,** 613; Chem. Centrbl., **1893,** b, 596; Ztschr. anorg. Chem., **5,** 316.

See title.

1893: 3. CARNOT, A. Sur l'essai des oxydes de manganèse par l'eau oxygenée.

Bull. soc. chim. (3), **9,** 646; C. R., **116,** 1295; Chem. Centrbl., **1893,** b, 191; J. Chem. Soc. (Lond)., **64,** b, 497; J. Soc. Chem. Ind., **12,** 897; Ztschr. anorg., Chem., **6,** 81.

Determination by a gasometric method similar to that of Lunge. See 1885: 13.

1893: 4. CARNOT, A. Sur le dosage du manganèse par les méthodes oxydimétriques.

C. R., **116**, 1375; Chem. Centrbl., **1893**, b, 292; Ztschr. anorg. Chem., **5**, 100 and 249; J. Iron Steel Inst., **1893**, a, 530, Chem. News, **68**, 51; Chem. Ztg., **17**, 164 and 179, Rep.; Ber., **26**, 528 and 728, Ref.; School Mines Quart., **15**, 55; J. Soc. Chem. Ind., **12**, 787; Analyst, **18**, 231.

Determination by measurement of the gas evolved when manganese dioxide is titrated with hydrogen peroxide. See 1885: 13, 1890: 1, and 1893: 3.

1893: 5. CLARK, J. The Use of Sodium Peroxide as an Analytical Agent.

J. Chem. Soc. (Lond.), **63**, 1082; Ztschr. anal. Chem., **34**, 593.

Separation from zinc, nickel, and cobalt by means of sodium peroxide.

1893: 6. GORGEU, A. Observation sur le dosage du manganèse par le permanganate de potasse, et sur les permanganates de manganèse de M. Antony Guyard.

Bull. soc. chim. (3), **9**, 214 and 490; Chem. Centrbl., **1893**, b, 155; J. Iron Steel Inst., **1894**, a, 613; J. Chem. Soc. (Lond.), **65**, b, 33.

Comments on the procedures of Guyard and Donath. See also 1893: 1, 1863: 2, and 1881: 6.

1893: 7. HEMPEL, W. Ueber die Anwendung des Natriumsuperoxyds zur Analyse.

Ztschr. anorg. Chem., **3**, 193.

Detection by means of sodium peroxide.

1893: 8. JEAN, F. (Discussion.)

Bull. soc. chim. (3), **9**, 99; Chem. Centrbl., 1893, a, 665.

See 1893: 9.

1893: 9. JEAN, F. Dosage du manganèse dans ses minerais et ses alliages.

Bull. soc. chim. (3), **9**, 248; J. Chem. Soc. (Lond.), **64**, b, 498; School Mines Quart., **14**, 362; Ztschr. anorg. Chem., **4**, 479.

Precipitation by means of sodium carbonate, solution in nitric acid, precipitation by potassium chlorate, and determination as phosphate, sulphide, or oxide; also volumetrically by methods of Pattinson, Guyard, Gay-Lussac, and Campredon. Separation from iron by the acetate method. See also 1893: 8.

1893: 10. JULIAN, F. Laboratory Notes.

J. Am. Chem. Soc., **15**, 113; Chem. Centrbl., **1893**, b, 393.

Precipitation by means of potassium chlorate, and titration with hydrogen peroxide

1893: 11. KOSMAN, B. Zur Trennung von Eisen und Aluminium, Mangan, Zink und Calcium.

Stahl u. Eisen, **13**, 431; Chem. Centrbl., **1893**, b, 155; J. Chem. Soc. (Lond.), **64**, b, 600; Ztschr. anorg. Chem., **4**, 397.
Separation from iron by the acetate method and precipitation by Wolff bromine procedure. Comments on Riggs method. See 1892: 14, and 1883: 22.

1893: 12. LOW, A. H. Technical Estimation of Manganese in Ores.

J. Anal. Chem., **6**, 663; Chem. Centrbl., **1893**, a, 665; Chem. News, **67**, 162; J. Iron Steel Inst., **1893**, a, 418; Ztschr. anorg. Chem., **4**, 320; Stahl u. Eisen, **13**, 608; Monit. scientif., **43**, 207; J. Chem. Soc. (Lond.), **64**, b, 438; School Mines Quart., **14**, 256; Eng. Min. J., **55**, 124.
Determination in ores by precipitation by means of bromine, solution in oxalic acid, and titration with permanganate.

1893: 13. PARRY, J., and MORGAN, J. J. The Analysis of Iron and Steel.

Chem. News, **67**, 295; Ind. and Iron, **1893**, 379; Stahl u. Eisen, **13**, 898; School Mines Quart., **15**, 64.
Separation from iron by the acetate method, and precipitation by bromine; also colorimetric method and study of Williams method (1881: 18).

1893: 14. RÜDORFF, F. Quantitative Analyse durch Elektrolyse.

Ztschr. angew. Chem., **1893**, 452.
Electrolytic determination, and separation from copper.

1894: 1. CHRISTOMANOS, A. C. Ueber einen neuen Kohlensäurebestimmungs-Apparat.

Ber., **27**, 2748; J. Soc. Chem. Ind., **13**, 1221.
Modified apparatus for use with the Bunsen method for the determination of the peroxide (1853: 1).

1894: 2. CLASSEN, A. Quantitative Analyse durch Elektrolyse.

Ber., **27**, 2075; J. Chem. Soc. (Lond.), **66**, b, 480; Ztschr. anorg. Chem., **16**, 269; Ztschr. Elektrochem., **1**, 290.
Determination by electrolysis.

1894: 3. FLEITMANN, T. Ueber die quantitative Bestimmung der gewöhnlichsten Beimischungen des im Handel vorkommenden Reinnickels, oder Walznickels.

Ztschr. anal. Chem., **33**, 337.
Determination in commercial nickel.

1894: 4. JONES, H. C. Sur l'essai des oxydes du manganèse par l'eau oxygenée.

C.R., **117**, 781; Chem. Centrbl., **1894**, a, 229; Ber., **27**, 33, Ref.; J. Chem. Soc. (Lond.), **66**, b, 121.

Comments on Carnot's articles (1893: 1–4).

1894: 5. JONES, J. Rapid Method for the Determination of Manganese in Manganese Bronze.

J. Am. Chem. Soc., **15**, 414; Chem. Centrbl., **1894**, a, 108; Ztschr. anal. Chem., **37**, 338; Eng. Min. J., **57**, 347; Chem.-techn. Rep., **34**, a, 297; Monit. scientif., **36**, 521; School Mines Quart., **15**, 151; Berg- u. hüttenm. Ztg., **53**, 189.

Determination by the Hampe chlorate method (1883: 4).

1894: 6. KASSNER, O. Ueber Natriumsuperoxyd und seine Anwendung in der Analyse.

Arch. Pharm., **232**, 226; Ztschr. anal. Chem., **34**, 595; J. Chem. Soc. (Lond.), **66**, b, 429.

Separation from chromium by means of sodium peroxide.

1894: 7. KIPPENBERGER, C. Ein einfacher Apparat für gasanalytische Zwecke.

Ztschr. angew. Chem., **1894**, 714; Ztschr. anal. Chem., **35**, 185.

Apparatus for gasometric determination of peroxide by measurement of oxygen evolved during reaction with hydrogen peroxide.

1894: 8. LUNGE, G. Volumétre à gaz universel.

Bull. soc. chim. (3), **11**, 636.

Gasometric determination of peroxide.

1894: 9. NASS, G. Ueber die quantitative Bestimmung von Mangan, Magnesium, Zink, Kobalt und Nickel, mittels der Oxalatmethode nach Prof. A. Classen.

Ztschr. angew. Chem., **1894**, 501; Chem. Centrbl., **1894**, b, 601; Ztschr. anorg. Chem., **7**, 364; Chem. Ztg., **18**, 227, Rep.; Ber., **28**, 22, Ref.; J. Chem. Soc. (Lond.), **66**, b, 482; J. Soc. Chem. Ind., **14**, 69.

General study of Classen's method. See 1877: 3 and 7.

1894: 10. NEUMANN, G. Quantitative Analyse von Schwermetallen durch Titriren mit Natriumsulfid.

Monatsh. Chem. **15**, 495; J. Chem. Soc. (Lond.), **68**, b, 64; Chem. News, **72**, 212; Ztschr. anal. Chem., **34**, 454.

Addition of alkaline sulphide in excess, filtration, addition of sulphuric acid in excess, and titration with alkali.

1894: 11. POLECK, T. Ueber Natriumsuperoxyd.

Ber., **27**, 1052.

Separation from chromium by means of sodium peroxide. See 1894: 6.

1894: 12. RÜDORFF, F. Quantitative Analyse durch Elektrolyse.

Ztschr. angew. Chem., **1894,** 388; J. Chem. Soc. (Lond.), **66,** b, 399.
Separation from mercury.

1894: 13. SANITER, E. H. A Review of Some of the Methods in General Use for the Estimation of Manganese in Minerals and Metals.

J. Soc. Chem. Ind., **13,** 112; Ber., **28,** 75, Ref.; J. Iron Steel Inst., **1894,** a, 613; J. Chem. Soc. (Lond.), **66,** b, 333; School Mines Quart., **15,** 275; Eng. Min. J., **57,** 155.
Tests of methods involving precipitation as peroxide by bromine, and as sulphide and phosphate; also Volhard's and Pattinson's methods.

1894: 14. SEELIGER, R. Quantitative Trennung von Ferriphosphat, Manganophosphat, Calcium- und Magnesiumphosphat.

* Dissertation, Erlangen; Pharm. Centrh. (2), **14,** 685; Chem. Centrbl., **1894,** a, 107; J. Chem. Soc. (Lond.), **66,** b, 255.
Determination by permanganate, and by Rössler silver method (1879: 13). Separation from iron by fusion with silica and alkaline carbonates and nitrates.

1894: 15. SMITH, E. F., and HEYL, P. Ueber die Verwendung von Quecksilberoxyd bei der Analyse.

Ztschr. anorg. Chem., **7,** 85, 88, and 89; Ber. **27,** 758, Ref.; Ztschr. anal. Chem., **34,** 74 and 75.
Separation from iron by means of mercuric oxide.

1894: 16. THOMÄLEN, H. Ueber die von Rüdorff empfohlenen Methode der quantitativen Analyse durch Elektrolyse.

Chem. Ztg., **18,** 1353; Chem. Centrbl., **1894,** b, 667.
Electrolytic determination. See 1892: 18.

1894: 17. ULLMANN, C. Apparat zur Braunsteinbestimmung nach der Bunsen'schen Methode.

Chem. Ztg., **18,** 478; Chem. Centrbl., **1894,** a, 878; Ztschr. anal. Chem., **37,** 387; Ber., **27,** 524 Ref.; J. Chem. Soc. (Lond.), **68,** b, 88; J. Soc. Chem. Ind. **13,** 979.
See title and 1888: 5; also 1894: 1.

1895: 1. ALVAREZ, P., and JEAN, J. Recherche du zinc, du chrome, du manganèse et du fer.

Répert. de pharm. **1895,** 440; Chem. Centrbl., **1896,** b, 513; Pharm. Centrh., **37,** 472; J. Chem. Soc. (Lond.), **72,** b, 600.
Detection by oxidation to permanganic acid by means of lead peroxide in nitric acid solution.

1895: 2. AUCHY, G. The Volumetric Estimation of Manganese.

J. Am. Chem., Soc., **17**, 943; Chem. Centrbl., **1896**, a, 460; J. Chem. Soc. (Lond.), **70**, b, 339; School Mines Quart., **17**, 313; J. Soc. Chem. Ind., **15**, 220.

Criticism and comments on the Williams (1881: 18) and the Volhard (1879: 14) methods.

1895: 3. BODLÄNDER, G. Das Gasgravimeter für chemische Analyse auf gasometrischen Wege.

Ztschr. angew. Chem. **1895**, 55.

Determination of peroxide in pyrolusite (or after precipitation by potassium chlorate from iron), by means of hydrogen peroxide.

1895: 4. CARNOT, A. (Title unknown).

* Echo Mines, **1895**; Berg- u. hüttenm Ztg., **1895**, 173; Wagner's Jsb., **41**, 199; * Génie civil, **26**, 140; J. Iron Steel Inst., **1895**, a, 507.

Precipitation with hydrogen peroxide, solution of the precipitate in an excess of oxalic acid, and titration for this excess.

1895: 5. ENGELS, C. Vorläufige Mittheilung.

Ztschr. anorg. Chem., **9**, 78; J. Chem. Soc. (Lond.), **68**, b, 419; Chem. Centrbl., **1895**, b, 183; Ber., **28**, 628, Ref.

Electrolytic precipitation with the aid of hydrogen peroxide.

1895: 6. ENGELS, C. Quantitative Bestimmung von Mangan und Zink durch Elektrolyse.

Ber., **28**, 3182; Ztschr. Elektrotech. u. Elektrochem., **2**, 413; Chem. Centrbl., **1896**, a, 327; Bull. soc. chim. (3), **16**, 744; Ztschr. anorg. Chem., **12**, 400; Chem. Ztg., **20**, 44, Rep.; Ztschr. angew. Chem., **1896**, 76; J. Chem. Soc. (Lond.), **70**, b, 276; J. Soc. Chem. Ind., **15**, 219; Wagner's Jsb., **42**, 335; Ann. chim. anal. appl., **1**, 119.

Deposition as peroxide from a solution containing much sodium acetate and chrome alum, or a hydroxylamine salt.

1895: 7. FORESTIER, H. Essai des aciers, fers et fontes par l'analyse chimique.

Bull. soc. chim. (3), **13**, 587.

Separation from iron by the acetate method or with zinc oxide. Determination by precipitation by means of chlorate or hydrogen peroxide, and ignition to mangano-manganic oxide; or titration with ferrous sulphate or oxalic acid solution; or colorimetric determination by oxidation to permanganic acid by lead peroxide or bismuth tetroxide.

1895: 8. GRÖGER, M. Zur elektrolytischen Bestimmung des Mangans.

Ztschr. angew. Chem., **1895**, 253; Chem. Centrbl., **1895**, a, 1190; School Mines Quart., **16**, 376; Ztschr. anorg. Chem., **11**, 69; **12**, 400; Ber., **28**, 567, Ref.; Berg- u. hüttenm. Ztg., **54**, 211; Chem. -techn. Rep., **34**, 274; J. Chem. Soc. (Lond.), **68**, b, 419.

Criticism of Rudorff electrolytic method. Precipitation by electrolysis and determination as peroxide. See also 1892: 18.

1895: 9. JANNASCH, P., and v. CLOEDT, E. Ueber quantitative Metalltrennungen in alkalischen Lösung durch Wasserstoffsuperoxyd. XI. Die Trennung des Wismuths, Bleis und Mangans von Quecksilber.

Ber., **28**, 994; Chem. News, **72**, 65; Chem. Centrbl., **1895**, b, 64; Bull. soc. chim. (3), **14**, 1354; J. Chem. Soc. (Lond.), **68**, b, 332; Ann. chim. anal. appl., **1**, 75.
Separation from mercury by means of hydrogen peroxide.

1895: 10. JANNASCH, P., and v. CLOEDT, E. Ueber quantitative Metalltrennungen in alkalischen Lösung durch Wasserstoffsuperoxyd. XIII. Die Trennung des Chroms von Mangan, Eisen und Aluminium.

Ztschr. anorg. Chem., **10**, 398; Chem. Centrbl., **1896**, a, 220; J. Chem. Soc. (Lond.), **70**, b, 222.
Separation from chromium by means of hydrogen peroxide.

1895: 11. JANNASCH, P., and v. CLOEDT, E. Ueber die Trennung des Mangans von Zink in ammonialkalischer Lösung durch Wasserstoffsuperoxyd unter Anwendung von Druck.

Ztschr. anorg. Chem., **10**, 405; Chem. Centrbl., **1896**, a, 221; J. Chem. Soc. (Lond.), **70**, b, 220; Chem.-techn. Rep., **34**, a, 275.
See title.

1895: 12. JANNASCH, P., and KAMMERER, H. Ueber quantitative Metalltrennungen in alkalischen Lösung durch Wasserstoffsuperoxyd. XII. Die Trennung des Mangans von Silber und des Wismuth von Kobalt.

Ber., **28**, 1407; Chem. Centrbl., **1895**, b, 254; Chem. News, **72**, 91; J. Chem. Soc. (Lond.), **68**, b, 423; J. Soc. Chem. Ind., **14**, 1889; Bull. soc. chim. (3), **14**, 1273.
Separation from silver by means of hydrogen peroxide.

1895: 13. JANNASCH, P., and KAMMERER, H. Ueber quantitative Metalltrennungen in alkalischen Lösung durch Wasserstoffsuperoxyd. XIV. Trennung des Arsens von Eisen und Mangan.

Ztschr. anorg. Chem., **10**, 408; Chem. Centrbl., **1896**, a, 221; J. Chem. Soc. (Lond.), **70**, b, 221.
Separation from arsenic by means of hydrogen peroxide.

1895: 14. JANNASCH, P., and RÖTTGEN, A. Ueber quantitative Metalltrennungen in alkalischen Lösung durch Wasserstoffsuperoxyd. X. Trennung des Wismuths und des Bleies von Cadmium, sowie diejenige des Mangans von Kupfer und Cadmium.

Ztschr. anorg. Chem., **8**, 307, 310, and 312; Chem. Centrbl., **1895**, a, 1042; Ber., **28**, 435, Ref.; J. Chem. Soc. (Lond.), **68**, b, 332.

Separation from copper and cadmium by means of hydrogen peroxide.

1895: 15. V. JÜPTNER, H. Einige Ursachen der mangelnden Uebereinstimmung bei Manganbestimmungen in Ferromangan.

Oester. Ztschr. Berg- u. Hüttenw., **43**, 166; J. Iron Steel Inst., **1895**, a, 140; Stahl u. Eisen, **15**, 416; Berg- u. hüttenm. Ztg., **54**, 235.

Variation in the results obtained in the determination in ferromanganese caused in part by variation in atomic weights chosen.

1895: 16. NEUMANN, B. Welche electrolytischen Methoden sind in der analytischen Praxis mit Vorteil verwendbar?

Ztschr. Electrochem., **1895**, 231 and 252; Ztschr. anorg. Chem., **12**, 399.

General discussion of methods of determination, especially electrolytic methods.

1895: 17. REDDROP, J., and RAMAGE, H. The Volumetric Determination of Manganese.

Proc. Chem. Soc. (Lond.), **1895**, 33; J. Chem. Soc. (Lond.), **67**, 268; Ber., **28**, 652; **29**, 698, Ref.; Chem. Centrbl., **1895**, a, 1042; Wagner's Jsb., **42**, 182; J. Soc. Chem. Ind., **14**, 305; Chem. News, **71**, 122; Bull. soc. chim. (3), **14**, 1183; School Mines Quart., **17**, 313; J. Iron Steel Inst., **1895**, a, 508.

Comments on Schneider's method. Oxidation with sodium bismuthate and titration with hydrogen peroxide. See 1889: 17.

1895: 18. THOMAS, W. S. Methods for the Determination of Manganese.

Bull. Missouri Min. Club, **1895**, 35; J. Am. Chem. Soc., **17**, 341; Chem. Centrbl., **1895**, a, 1083; J. Iron Steel Inst., **1895**, b, 595; Chem. Ztg., **19**, 155, Rep.; Bull. soc. chim. (3), **14**, 921; J. Chem. Soc. (Lond.), **68**, b, 420; School Mines Quart., **16**, 376; Stahl u. Eisen, **15**, 1059; Berg- u. hüttenm. Ztg., **54**, 326.

Criticism of the Low method. Recommends the use of the Volhard method. See 1893: 12.

1895: 19. ULZER, F., and BRÜLL, J Ueber die Manganbestimmung im Roheisen.

Mitth. technol. Gen. Mus. (Wien), **1895**, 312; J. Iron Steel Inst., **1896**, b, 442; **1897**, b, 497; Chem. Ztg., **20**, 36, Rep.; Ztschr. angew. Chem., **1896**, 78; Wagner's Jsb., **42**, 103; Stahl. u. Eisen, **16**, 633; Berg- u. hüttenm. Ztg., **55**, 301; J. Soc. Chem. Ind., **15**, 296; Analyst, **21**, 139; Chem. Centrbl., **1897**, a, 769; J. Chem. Soc. (Lond.), **72**, 350; Ann. chim. anal. appl., **1**, 135.

Separation from iron by zinc oxide, precipitation by means of hydrogen peroxide, solution in oxalic acid, and titration for

the excess of the latter. Discussion of Hampe, Weissmann, and Vortmann articles. See 1883: 4, 1888: 20, and 1890: 16.

1896: 1. AUCHY, G. Sources of Error in Volhard's and Similar Methods of Determining Manganese in Steel.

J. Am. Chem. Soc., **18**, 498; Chem. Centrbl., **1896**, b, 208; Chem. News, **74**, 214, 248, and 262; J. Chem. Soc. (Lond.), **70**, b, 627; School Mines Quart., **18**, 43; Eng. Min. J., **61**, 111; J. Soc. Chem. Ind., **15**, 677; Analyst, **21**, 335.

Sources of error in volumetric and colorimetric determinations. See 1879: 14, and 1896: 15.

1896: 2. BURGASS, R. Anwendung des Nitroso-β-naphthols in der anorganischen Analyse.

Ztschr. angew. Chem., **1896**, 601; J. Chem. Soc. (Lond.), **72**, b, 163.

Separation from iron, copper, and cobalt by means of nitroso-β-naphthol.

1896: 3. BÜTTGENBACH, F. Estimation de la valeur du manganèse dans les minerais de fer.

Rev. univers. de mines, **32**, 317; Berg- u. hüttenm. Ztg., **55**, 368; Oester. Ztschr. Berg- u. Hüttenw., **1896**, 65; Wagner's Jsb., **42**, 182; J. Chem. Soc. (Lond.), **74**, b, 52.

Determination by assay tests on manganese ores.

1896: 4. DEWEY, F. P. The Actual Accuracy of Chemical Analysis.

Trans. Am. Inst. Min. Eng., **26**, 370; J. Am. Chem. Soc., **18**, 808.

Determination, and a comparison of the results obtained by various chemists.

1896: 5. DUDLEY, C. B. Some Present Possibilities in the Analysis of Iron and Steel.

J. Am. Chem. Soc., **19**, 104.

Volumetric determination by precipitation with chlorate and titration with oxalic acid or ferrous sulphate solution in comparison with gravimetric determination as phosphate.

1896: 6. ENGELS. Beiträge zur Elektroanalyse der Metalle der Schwefelammoniumgruppe.

Chem. Rundschau, **1896**, 5 and 22; Chem. Centrbl., **1897**, a, 258; Ztschr. anorg. Chem., **14**, 439; J. Chem. Soc. (Lond.), **74**, b, 192.

Separation from iron and nickel by electrolysis.

1896: 7. GIORGIS, G. Sul dosamento del manganese e del cromo nei prodotti siderurgici.

Gazz. chim. ital., **26**, b, 528; Chem. Centrbl., **1897**, a, 436; Bull. soc. chim. (3), **18**, 953; J. Iron Steel Inst., **1897**, b, 498; J. Chem. Soc. (Lond.), **72**, b, 350.

Determination by addition of the solution to an excess of potassium permanganate and titration for the excess with a solution of chromium sulphate.

1896: 7a. HANDY, J. O. Aluminium Analysis.

J. Am. Chem. Soc., **18**, 766; Ann. chim. anal. appl., **2**, 90.

Determination in aluminium-manganese alloys by the Williams method.

1896: 8. JANNASCH, P. Ueber Trennungen des Mangans von Kupfer und Zink (Wasserstoffsuperoxyd Methode), sowie des Kupfers von Zink und Nickel (Schwefelwasserstoff und Rhodanmethode) nebst ergänzenden Bemerkungen.

Ztschr. anorg. Chem., **12**, 134; Chem. Centrbl., **1896**, b, 208; J. Chem. Soc. (Lond.), **70**, b, 546; Ber., **29**, 696, Ref.; Analyst, **22**, 80.

1896: 9. JANNASCH, P., and LEHNERT, H. Ueber quantitative Metalltrennungen in alkalischer Lösung durch Wasserstoffsuperoxyd. XV. Trennungen in natronalkalischer Lösung.

Ztschr. anorg. Chem., **12**, 126; Chem., Centrbl. **1896**, b, 209; J. Chem., Soc. **70**, b, 547; Ber., **29**, 695, Ref.

Separation from cobalt and nickel by means of hydrogen peroxide in alkaline potassium cyanide solution.

1896: 10. V. JÜPTNER, H. Einige Ursachen der mangelnden Uebereinstimmung bei Manganbestimmungen im Ferromangan.

Oester. Ztschr. Berg- u. Hüttenw., **44**, 15; Chem. Centrbl., **1896**, a, 513; Chem. Ztg., **20**, 52, Ref.; Analyst, **21**, 196.

Criticism of methods of standardizing permanganate solutions.

1896: 11. MIGNOT, A.

* Rev. chim. anal. appl., **4**, 329 and 390; Chem. Ztg., **20**, 234 and 275, Rep.

Separation from iron with ammonium succinate, precipitation with chlorate, and re-precipitation with bromine or salt of phosphorus. Also colorimetric determination by oxidation by means of lead peroxide or bismuth tetroxide in nitric acid solution.

1896: 12. MIXER, C. T., and DUBOIS, H. W. Särnström's Method of Determining Manganese in Iron Ores.

J. Am. Chem. Soc., **18**, 385; Chem. Centrbl., **1896**, a, 1082; Chem. News, **75**, 51; J. Chem. Soc. (Lond.), **70**, b, 547; Bull. soc. chim. (3), **16**, 1416; J. Iron Steel Inst., **1896**, b, 448; School Mines Quart., **18**, 43; Ann. chim. anal. appl., **1**, 196.

Determination by the Swedish method as modified by Särnström. See 1881: 15.

1896: 13. MURKEWITSCH, M. Bestimmung des Mangans in Gusseisen, Stahl, Eisen und dergl. (*Title from Chem. Ztg.*)

* Gornij. J., **1896**, 396; Chem. Ztg., **20**, 220, Rep.; Oester. Ztschr. Berg- u. Hüttenw., **46**, 53.

Determination by the Volhard method. See 1879: 14.

1896: 13a. NEUMANN, B. Die elektrolytische Bleibestimmung u. ihre Beeinflussung durch die Gegenwart von Arsen, Selen, Mangan.

Chem. Ztg., **20**, 383.
Separation from lead by electrolysis.

1896: 14. RÜRUP, L. Vergleichende Manganbestimmungen in Stahl und Eisen.

Chem. Ztg., **20**, 285 and 337; Chem. Centrbl., **1896**, a, 1144 and 1178; Ztschr. anorg. Chem., **15**, 383; Berg- u. hüttenm. Ztg., **55**, 216; Analyst, **21**, 218; J. Iron Steel Inst., **1896**, a, 535.
Comparative determinations as manganous sulphate, as manganomanganic oxide, by removal of the iron with sodium sulphate and titration with permanganate, by the Ford, the Volhard, and the Hampe chlorate methods. See 1881: 8, 1879: 14, and 1883: 4.

1896: 15. STONE, G. C. Remarks on Mr. Auchy's Paper on the Volumetric Determination of Manganese.

J. Am. Chem. Soc., **18**, 228; Chem. Centrbl., **1896**, a, 1028; Bull. soc. chim. (3), **16**, 1238; J. Iron Steel Inst., **1896**, b, 443; J. Chem. Soc. (Lond.), **70**, b, 547; School Mines Quart., **18**, 43.
Recommends the Volhard method with slight modification. See 1896: 1.

1896: 16. TAGGART, W. T., and SMITH, E. F. The Separation of Manganese from Tungstic Acid.

J. Am. Chem. Soc., **18**, 1053; Chem. Centrbl., **1897**, a, 309; Chem. News, **75**, 26; Chem. Ztg., **21**, 10, Rep.; Bull. soc. chim. (3), **18**, 626; J. Chem. Soc. (Lond.), **72**, b, 433; J. Soc. Chem. Ind. **16**, 164.
Inadvisability of using ammonium sulphide or alkaline carbonates in effecting a separation from tungstic acid.

1896: 17. VIARD, G. Sur le dosage du manganèse en présence de l'acid phosphorique.

Bull. soc. chim. (3), **15**, 973; Chem. Centrbl., **1896**, b, 600; J. Chem. Soc. (Lond.), **72**, b, 519; J. Soc. Chem. Ind., **15**, 677; Ann. chim. anal. appl., **1**, 332.
Inapplicability of the Hannay, and the Beilstein and Jawein method of determination, in the presence of phosphoric acid. See 1877: 10 and 1879: 1.

1897: 1. AUCHY, G. A Method for the Complete Analysis of Iron Ores, with Notes on Särnström's Method of Determining Manganese.

J. Am. Chem. Soc., **19**, 139; Chem. Centrbl., **1897**, a, 883; J. Iron Steel Inst., **1898**, a, 539; J. Chem. Soc. (Lond.), **72**, b, 603.
Comments on Särnström's method. See 1881: 15.

1897: 2. VAN BEMMELEN, J. M. Beiträge zur Analyse der Ackerböden. (*Title from Ztschr. anal. Chem.*)

* Landw. Vers.-Stat., **37**, 279; Ztschr. anal. Chem., **36**, 799.
Determination in soils by the Carnot method. See 1888: 2.

1897: 3. BREARLEY, H. The Estimation of Manganese in Spiegels.

Chem. News, **75**, 13; Chem. Centrbl. **1897**, a, 335; Bull. soc. chim. (3), **18**, 1300; J. Iron Steel Inst., **1897**, b, 498; J. Chem. Soc. (Lond.), **72**, b, 233.
Application of Wright and Menke's modification of Guyard's method to the determination of manganese in the filtrate from the acetate separation. See 1880: 17 and 18.

1897: 4. BREARLEY, H. Separation with Alkaline Acetates.

Chem. News, **76**, 165; Chem. Centrbl., **1897**, b, 911; J. Chem. Soc. (Lond.), **74**, b, 96.
Separation from iron by the acetate method.

1897: 5. CUSHMAN, A. R. A New and Rapid Method for the Qualitative Separation of Iron, Aluminium, Chromium, Manganese, Zinc, Nickel, and Cobalt.

Am. Chem. J., **19**, 606; Chem. Centrbl., **1897**, b, 434; J. Chem. Soc. (Lond.), **72**, b, 518; Ann. chim. anal. appl., **3**, 20.
Qualitative detection and separation. Use of bromine in connection with alkaline hydroxides.

1897: 6. DEVISSE, N. De la calcination des minerais manganesiferes carbonates.

Rev. univ. des mines (3), **39**, 1897; Chem. News, **76**, 212; J. Chem. Soc. (Lond.), **74**, b, 142.
Volumetric determination by the Volhard method.

1897: 7. ENGELS, C. Quantitative Bestimmung von Mangan durch Elektrolyse.

Ztschr. Elektrochem., **3**, 286 and 305; Chem. Centrbl., **1897**, a, 308 and 436; Ztschr. anorg. Chem., **14**, 438; Chem. Ztg., **21**, 40, Rep.; J. Chem. Soc. (Lond.), **74**, b, 52; J. Soc. Chem. Ind., **16**, 262; Dingl. pol. J., **304**, 262.
See title.

1897: 8. GRANGER, A. Sur les phosphures de chrome et de manganèse.

C. R., **124**, 190; Chem. News, **75**, 95.
Determination as sulphide in chromium and manganese phosphides.

1897: 8a. HILLEBRAND, W. F. Some Principles and Methods of Analysis Applied to Silicate Rocks.

Bull. U. S. Geol. Surv. **No. 148**, 41; Chem. News, **78**, 80.
Separation from cobalt, nickel, and copper by solubility of sulphides in hydrochloric acid. Precipitation as carbonate and ignition to oxide. Comments on Jannasch and Cloedt's separation from zinc. See 1895: 11.

1897: 9. JULIAN, F. Manganbestämningsmetod.

Jern.-Kont. Ann., **52**, 118; Berg.- u. hüttenm. Ztg., **56**, 410; J. Iron Steel Inst., **1898**, b, 557; Chem. Ztg., **21**, 313, Rep.; J. Soc. Chem. Ind., **17**, 185; Ann. chim. anal. appl., **3**, 56.

Precipitation by chlorate in the presence of nitric acid, solution of the precipitate in an excess of hydrogen peroxide, and titration for this excess with permanganate.

1897: 10. LONGI, A., and CAMILLA, S. Intorno alla determinazione del manganese nelle soluzioni manganose e permanganiche.

Gazz. chim. ital., **27**, a, 97; Chem. Centrbl. **1897**, a, 619; Ztschr. anorg. Chem., **17**, 158; **18**, 403; Bull. soc. chim. (3), **18**, 952; J. Chem. Soc., **72**, b, 387.

Modification of the Volhard method (1879: 14).

1897: 11. LEMAIRE, M. Dosage colorimétrique du manganèse.

* Bull. soc. pharm. Bordeaux, **1897**, 268; Chem. News, **76**, 219; Ann. chim. anal. appl., **2**, 409.

Colorimetric method, determination in plants. Oxidation to permanganic acid in nitric acid solution by means of lead peroxide.

1897: 12. MILLER, E. H. Notes on the Ferrocyanides of Zinc and Manganese.

J. Am. Chem. Soc., **18**, 1100; Chem. Centrbl., **1897**, a, 283; Chem. News, **75**, 186.

Volumetric determination as ferrocyanide.

1897: 13. MILLER, E. H., and MATHEWS, J. A. On the Ferrocyanides of Zinc and Manganese.

J. Am. Chem. Soc., **19**, 547; Chem. Centrbl., **1897**, b, 538.

Volumetric determination as ferrocyanide.

1897: 14. PURGOTTI, A. Supra un nuovo metodo di determinazione di alcune sostanze per mezzo del solfato d'idrazina.

Gazz. chim. ital., **26**, b, 568; Chem. Centrbl., **1897**, a, 488; Ztschr. anorg. Chem., **18**, 403; Pharm. Centrh., **1897**, 551; Ann. chim. anal. appl., **2**, 414.

Gasometric determination, with the aid of hydrazine-sulphate.

1897: 15. SCHNEIDER, L. Ein Beitrag zu den vergleichenden Manganbestimmungen in Stahl und Eisen von L. Rürup.

Chem. Ztg., **21**, 41; Chem. Centrbl., **1897**, a, 436; J. Iron Steel Inst., **1898**, a, 534; J. Chem. Soc. (Lond.), **74**, b, 94; Analyst, **22**, 110.

Comments on Rürup's comparative determinations. See 1896: 14.

Reference to colorimetric methods by oxidation to permanganic acid.

1897: 16. STONE, G. C., and VAN INGEN, D. A. The Ferrocyanides of Zinc and Manganese.

J. Am. Chem. Soc., **19**, 542; Chem. Centrbl., **1897**, b, 538.
Volumetric determination as ferrocyanide.

1897: 17. WYNKOOP, G. Qualitative Separations with Sodium Nitrite in Absence of Phosphates.

J. Am. Chem. Soc., **19**, 434; J. Chem. Soc. (Lond.), **74**, b, 54.
Separation from iron by means of sodium nitrite.

1898: 1. AUSTIN, M. On the Estimation of Manganese Separated as the Carbonate.

Am. J. Sci. (4), **5**, 382; Ztschr. anorg. Chem., **17**, 272; Chem. Centrbl., **1898**, b, 65; Chem. News, **77**, 243; **78**, 239; Ztschr. angew. Chem., **1898**, 581 and 1131; Chem. Ztg., **22**, 212, Rep.; Wagner's Jsb., **44**, 121; Chem.-techn. Rep., **37**, 610; J. Chem. Soc. (Lond.), **74**, b, 646; School Mines Quart., **20**, 303.
Precipitation as carbonate, and determination as the oxide or the sulphate.

1898: 2. BIALOBSZCSKI, M. Die Anwendung saurer Lösungen von arseniger Säure in der Maassanalyse. (*Title from Ztschr. anal. Chem.*).

* Pharm. Ztschr. f. Russland, **35**, 785; Ztschr. anal. Chem., **37**, 445.
Determination of manganese peroxide by the use of arsenious acid.

1898: 3. BREARLEY, H. Separations from Chromic Acid. II. The Separation of Manganese.

Chem. News, **77**, 131; Chem. Centrbl., **1898**, a, 961; J. Chem. Soc., **74**, b, 409.
Separation from chromic acid by the use of sodium carbonate in cold solution and by the use of sodium hydrogen phosphate.

1898: 4. CAMPREDON, L. Sur le dosage rapide des principaux éléments des produits sidérurgiques.

Rev. chim. indust., **9**, 306.
Comparison of the Schneider method with the Volhard method. See 1885: 15, and 1879: 14.

1898: 4a. DENIGES. Réactions de quelques métaux de groupe du fer en milieu glycériné.

* Bull. soc. pharm. Bordeaux, **1898**, 97; Ann. chim. anal. appl., **3**, 230.
Detection in the presence of cobalt and nickel by means of reactions occurring in alkaline solutions containing glycerine.

1898: 5. ENGEL, C. Analyse électrolytique, dosage des métaux precipitables par le sulphure ammonique.

L'Éclairage electrique, **14**, 106; Chem. Centrbl. **1898**, b, 557; Ztschr. Elektrochem., **5**, 37; School Mines Quart., **20**, 302; J. Soc. Chem. Ind., **17**, 796.

Electrolytic separation from iron, cobalt, and nickel.

1898: 6. FORD, A. P., and BREGOWSKY, J. M. Use of Hydrofluoric Acid in the Determination of Manganese in Iron and Ores.

J. Am. Chem. Soc., **20**, 504; Chem. Centrbl., **1898**, b, 508; Chem. Ztg., **22**, 198, Rep.; Bull. soc. chim. (3), **22**, 9; Chem.-techn. Rep. **37**, 610; Wagner's Jsb., **44**, 121; J. Chem. Soc. (Lond.), **74**, b, 540; School Mines Quart., **20**, 303; J. Soc. Chem. Ind., **17**, 796; Analyst, **23**, 303.

Use of hydrofluoric acid to hold the silica in solution when precipitating manganese peroxide by the Williams method (1881: 18).

1898: 7. GOOCH, F. A., and AUSTIN, M. The Estimation of Manganese as the Sulphate and as the Oxide.

Am. J. Sci. (4), **5**, 209; Ztschr. anorg. Chem., **17**, 264; Chem. Ztg., **22**, 212, Rep.; Chem. Centrbl., **1898**, b, 1150; J. Chem. Soc. (Lond.), **74**, b, 646; J. Iron Steel Inst., **1898**, b, 558; Chem. News, **77**, 255; Bull. soc. chim. (3), **20**, 694; Wagner's Jsb., **44**, 121; Eng. Min. J., **65**, 585; Chem.-techn. Rep., **37**, 610.

Determination as sulphate and as oxide.

1898: 8. GOOCH, F. A., and AUSTIN, M. On the Determination of Manganese as the Pyrophosphate.

Am. J. Sci. (4), **6**, 233; Ztschr. anorg. Chem., **18**, 339; Chem. Centrbl., **1899**, a, 378; Chem. News, **78**, 239 and 246; Chem. Ztg., **22**, 319, Rep.; Bull. soc. chim. (3), **22**, 197; Wagner's Jsb., **44**, 122; J. Chem. Soc. (Lond.), **76**, 128; School Mines Quart., **20**, 303 and 400; Analyst, **24**, 52.

Study of the proper conditions for precipitation as phosphate.

1898: 9. GOOCH, F. A., and AUSTIN, M. On the Condition of Oxidation of Manganese Precipitated by the Chlorate Process.

Am. J. Sci. (4), **5**, 260; Ztschr. anorg. Chem., **17**, 253; Chem. Centrbl., **1898**, a, 1203; Ztschr. angew. Chem., **1898**, 664; Chem. News, **77**, 269 and 279; Chem. Ztg., **22**, 212, Rep.; Wagner's Jsb., **44**, 121; J. Chem. Soc. (Lond.), **74**, b, 645; School Mines Quart., **20**, 303; J. Soc. Chem. Ind., **17**, 796.

Precipitation with sodium chlorate and solution of the oxide in a sulphuric acid and potassium iodide solution, and titration for the liberated iodine with thiosulphate; or reduction of the oxide with arsenious acid and titration of the excess of that reagent.

1898: 10. DE GRAMONT, A. Analyse spectrale de quelques minéraux non conducteurs par les sels fondus et réactions des éléments.

C. R., **126**, 1513; J. Chem. Soc. (Lond.), **74**, b, 636.
Detection by spectrum analysis.

1898: 11. HILLEBRAND, W. F. See 1897: 8a.

1898: 12. JANNASCH, P., and ALFFERS, F. Ueber quantitative Metalltrennungen in ammoniakalischer und saurer Lösung durch Hydroxylamin und durch Hydrazin. (II) Die Trennung des Quecksilbers von Molybdän und Wolfram, sowie von den Metallen der Schwefelammoniumgruppe.

Ber., **31**, 2383; J. Chem. Soc. (Lond.), **76**, b, 60.
Separation from mercury.

1898: 13. KAEPPEL, F. Zur quantitative Bestimmung des Mangans und Trennung des Eisens von Mangan durch Elektrolyse.

Ztschr. anorg. Chem., **16**, 268; Chem. Centrbl., **1898**, a, 962; Ztschr. angew. Chem., **1898**, 435; Chem. Ztg., **22**, 118, Rep.; Chem. News, **77**, 201; **79**, 195; Bull. soc. chim. (3), **22**, 811; Chem.-techn. Rep., **37**, 287 and 610; Oester. chem. Ztg., **1**, 13; Ztschr. Elektrochem., **1898**, 41; Wagner's Jsb., **44**, 287; J. Chem. Soc. (Lond.), **74**, b, 354; School Mines Quart., **19**, 430; **20**, 400; J. Soc. Chem. Ind., **17**, 605; Analyst, **23**, 221; Dingl. pol. J., **310**, 16.
Deposition from faintly acid solution partly as metal and partly as peroxide.

1898: 14. LEHNKERING, P. Untersuchung von Eisenerzen. (*Title from Wagner's Jsb.*).

* Ztschr. öffenlich. Chem., **1898**, 459; Wagner's Jsb. **44**, 120; J. Soc. Chem. Ind., **17**, 951; J. Chem. Soc. (Lond.), **76**, 251.
Recommends the Volhard-Wolff method for determination in ores. Comments on the Hampe method. See 1884: 18, and 1883: 4.

1898: 15. MURMANN, E. Bemerkungen zur Bestimmungen des Zinks und Mangans als Sulfid.

Wien. Akad. Ber. (2b), **107**, 434; Monatsh. Chem., **19**, 404; Chem. Centrbl., **1898**, b, 1035; Analyst, **24**, 51; Ann. chim. anal. appl., **4**, 203; J. Soc. Chem. Ind., **17**, 1186; J. Chem. Soc. (Lond.), **76**, 126; Chem. News, **81**, 60.
Addition of mercuric chloride, precipitation of mercuric sulphide and manganous sulphide together, and expulsion of the mercuric sulphide by the ignition of the precipitate, in presence of hydrogen, in a special form of crucible.

1898: 16. MURMANN, E. Bemerkungen zur Analyse von Schmiedeeisen.

Oester. chem. Ztg., **1**, 383; Chem. Centrbl. **1898**, b, 1282; School Mines Quart., **20**, 303.
Gravimetric determination as sulphide.

1898: 17. NOTHOMB, M. Apparat zur Werthbestimmung des Braunsteins.

Chem. Ztg., **22,** 80; Chem. Centrbl., **1898,** a, 631; Analyst, **23,** 111.
Determination by loss of weight on treatment with oxalic acid.

1898: 18. PICHARD, P. Recherche et dosage rapide du manganèse dans les plantes et les terres végétates par une méthode colorimétrique.

C. R., **126,** 550; Chem. Centrbl., **1898,** a, 753; Chem. News, **77,** 108; Chem.-techn. Rep., **37,** 286; J. Soc. Chem. Ind., **17,** 273; Ann. chim. anal. appl., **3,** 123.
Oxidation in a nitric acid solution by means of lead peroxide.

1898: 19. PICHARD, P. Contribution à la recherche du manganèse dans les minéraux, les végétaux et les animaux.

C. R., **126,** 1882; Chem. Centrbl., **1898,** b, 381; J. Soc. Chem. Ind., **17,** 807; School Mines Quart., **19,** 429; J. Chem. Soc. (Lond.), **76,** 40.
Detection by colorimetric test. See also 1898: 18.

1898: 20. VITALI, D. Ueber den Nachweis des Mangans. (*Title from Chem. Centrbl.*).

* Boll. chim. Farm., **37,** 545; Chem. Centrbl., **1898,** b, 942; J. Chem. Soc. (Lond.), **76,** 251; Ann. chim. anal. appl., **3,** 408.
Detection by the use of bromates in a sulphuric acid solution.

1898: 21. WOLMAN, L. Beitrag zur quantitativen Elektrolyse von Schwermetallen.

Ztg. Elektrochem., **3,** 537; J. Chem. Soc. (Lond.), **74,** b, 50.
Influence of an oxalate, pyrophosphate, or acetic acid on the results obtained by electrolytic deposition from nitric-acid solution.

1899: 1. BREARLEY, H. The Estimation of Manganese by means of Potassium Permanganate.

Chem. News, **79,** 47 and 83.
A query on Mr. Daw's article on the Volhard process (1899; 4).

1899: 2. BREARLEY, H. Iron Separations with Alkaline Salts.

Chem. News, **79,** 193; J. Chem. Soc. (Lond.), **76,** 815.
Separation from iron by the acetate method.

1899: 3. BREARLEY, H. A Bibliography of Steel Works Analysis.

Chem. News, **80,** 233, 245, 257, 271.
A compilation of references from the Chemical News, 1860–1899, Journal of the Chemical Society (London), 1885–1898, and the Journal of the Iron and Steel Institute, 1880–1899, bearing on manganese in its relations to iron and steel analysis.

1899: 4. DAW, F. W. The Estimation of Manganese by Means of Potassium Permanganate.

Chem. News, **79**, 25, 58, and 104; Chem. Centrbl., **1899**, a, 504; Ztschr. angew. Chem. **1899**, 279; Chem. Ztg., **23**, 44, Rep.; Bull. soc. chim. (3), **22**, 443; J. Iron Steel Inst. **1899**, a, 465; Chem. -techn. Rep., **38**, 272; Wagner's Jsb., **45**, 130; School Mines Quart., **20**, 302; Analyst, **24**, 110; J. Chem. Soc. (Lond.), **76**, 334.

Criticism of the Volhard method (1879: 14).

1899: 5. DUNNINGTON, F. P. Composition of Manganese Pyrophosphate.

Chem. News, **79**, 275.

A notice of an error in "Fresenius Quantitative Analysis" (1876, Vol. 1).

1899: 6. FERNBERGER, H. M., and SMITH, E. F. The Electrolysis of Metallic Phosphate Solutions.

J. Am. Chem. Soc., **21**, 1001.

Electrolytic separation from copper.

1899: 7. FRIEDHEIM, C., and BRÜHL, E. Kritische Studien ueber die Anwendung des Wasserstoffsuperoxyds in der quantitativen Analyse.

Ztschr. anal. Chem., **38**, 686; J. Soc. Chem. Ind., **19**, 170.

Criticism of the work done by Jannasch regarding the use of hydrogen peroxide for the separation from copper, zinc, nickel, and chromium. See 1895: 10, 11, and 14, and 1896: 8 and 9.

1899: 8. HERTING, O. Beitrag zur Bestimmung des Kohlenstoffs, des Kupfers und Mangans im Eisen.

Ztschr. angew. Chem. **1899**, 1193; Chem. Centrbl., **1900**, a, 226; Wagner's Jsb., **45**, 129.

Preference given to the Gooch–Austin and the Volhard–Wolff methods. See 1898: 8 and 1884: 18.

1899: 9. HESS, W. H., and CAMPBELL, E. D. A New Method for the Direct Determination of Alumina in the Presence of Iron, Manganese, Calcium, and Magnesium.

J. Am. Chem. Soc., **21**, 776; J. Chem. Soc. (Lond.), **78**, 50; Ann. chim. anal. appl., **5**, 230.

Separation from aluminum by means of phenylhydrazine.

1899: 10. NAMIAS, R. Volumetric Estimation of Manganese. (*Title from J. Chem. Soc.*)

* Ann. Soc. chim. Melano, **1899**, 54; Chem. Centrbl., **1899**, a, 1224; J. Iron Steel. Inst., **1900**, a, 433; J. Chem. Soc. (Lond.), **78**, 50.

Use of the Volhard method (1879: 14).

1899: 11. NATTERER, K. Chemische Untersuchungen im Rothen Meere.

Monatsh. Chem., **20**, 12.

Colorimetric determination in the water of the Red Sea.

1899: 12. POZZI-ESCOT, M-. E. Analyse microchimique.

Ann. chim. anal. appl., **4**, 398.

Detection by microchemical tests.

1899: 13. REICHARD, C. Ueber die maassanalytische Bestimmung des Mangans in den mangansauren Salzen durch alkalische Lösungen von arseniger Säure.

Chem. Ztg., **23**, 801; Chem. Centrbl., **1899**, b, 886; J. Soc. Chem. Ind., **18**, 1156; J. Chem. Soc. (Lond.), **76**, b, 813; Chem. News, **82**, 308.

See title.

1899: 14. REICHARD, C. Ueber die quantitative Bestimmung der Mangansäure in Gegenwart von Mangansalzen, bezw. die Analyse der beiden Manganverbindungen neben einander mittels arseniger Säure in alkalischer Lösung.

Chem. Ztg., **23**, 867; Chem. Centrbl., **1900**, a, 66; J. Chem. Soc. (Lond.), **78**, 109; Ann. chim. anal. appl., **5**, 394; Analyst., **25**, 23.

See title.

1899: 15. RIEDERER, E. J. Electrolytic Determination of Zinc in the Presence of Manganese.

J. Am. Chem. Soc., **21**, 789; J. Chem. Soc. (Lond.), **78**, 49; Ann. chim. anal. appl., **5**, 266; Analyst, **25**, 79.

Separation from zinc by electrolysis.

1899: 16. J. T. Manganese in Chrome Steels.

Chem. News, **79**, 157.

Note on the Ford-Williams method (1881: 18).

1900: 1. BÖTTGER, W. Ueber die Bestimmung des Mangans als Pyrophosphat.

Ber., **33**, 1019; Chem. Centrbl. **1900**, a, 1140; J. Soc. Chem. Ind., **19**, 564; Chem. News, **82**, 247; J. Chem. Soc. (Lond.), **78**, 443; Analyst, **25**, 304.

Full discussion of the conditions which give the best results in the determination as pyrophosphate.

1900: 2. DAKIN, H. D. Zur Bestimmung von Mangan und Kobalt als Phosphat.

Ztschr. anal. Chem., **39**, 784.

Precipitation in the presence of a moderate excess of ammonium chloride and determination by weighing as ammonium manganese phosphate or the pyrophosphate. Comments on the article by Gooch and Austin. See 1898: 8.

1900: 3. HILLEBRAND, W. F. Some Principles and Methods of Rock Analysis.

Bull. U. S. Geol. Surv., **No. 176**, 60.

Separation from nickel and cobalt by means of the solubility of their sulphides. Precipitation as carbonate. Comments on the Jannasch and Cloedt method of separation from zinc by means of hydrogen peroxide. See 1895: 11 and 1899: 7.

1900: 4. HIORNS, A. The Electrolytic Estimation of Manganese in Manganese Ores.

Chem. News, **81**, 15; Chem. Centrbl., **1900**, a, 489; J. Chem. Soc. (Lond.), **78**, 444; Ann. chim. anal. appl., **5**, 230; School Mines Quart., **22**, 94.

Precipitation by electrolysis and ignition to mangano-manganic oxide.

1900: 5. IBBOTSON, F., and BREARLEY, H. The Estimation of Manganese and Chromium in Tungsten Alloys.

Chem. News, **82**, 209; Chem. Centrbl., **1900**, b, 1188; Chem. Ztg., **24**, 347, Rep.

Volumetric determination by oxidation to permanganate by means of lead peroxide in nitric acid solution, and titration with a reducing agent. Hydrofluoric acid used to aid in the solution of the alloy. (See also Norris, 1891: 19, and Ford and Bregowsky, 1898: 6).

1900: 6. IBBOTSON, F., and BREARLEY, H. The Estimation of Molybdenum in Steel and Steel-making Alloys.

Chem. News, **81**, 269; School Mines Quart., **22**, 97.

Influence of molybdenum on the determination of manganese by means of bromine and by the Williams–Ford method (1881: 18).

1900: 7. JERVIS, H. Note on the Estimation of Manganese in Steel.

Chem. News, **81**, 171; Chem. Centrbl., **1900**, a, 1038; J. Chem. Soc. (Lond.), **78**, 444; Stahl u. Eisen, **20**, 747; School Mines Quart., **22**, 94.

Determination in molybdenum powders and in tungsten steels by oxidation to permanganate by means of lead peroxide in nitric acid solution, and titration with oxalic acid or ferrous sulphate.

1900: 8. JOÜET, C. H. The Analysis of Slags and Cinders.

School Mines Quart., **22**, 71.

Determination by the Volhard method (1879: 14). Also precipitation by means of chlorate, separation from iron by means of acetates, and precipitation as phosphate.

1900: 9. McKENNA, A. G. The Analysis of Chrome and Tungsten Steels.

Eng. Min. J., **70**, 124; Chem. Ztg., **24**, 243, Rep; Analyst, **25**, 301.

Precipitation by means of potassium chlorate, solution of the precipitate in hydrochloric acid and potassium nitrite, separation from iron by means of acetates, re-precipitation by means of bromine, and ignition to mangano-manganic oxide.

1900: 10. MIGNOT, A. Dosage volumétrique du manganèse dans les fers, fontes et aciers.

Ann. chim. anal. appl., **5**, 172; Chem. Centrbl., **1900**, b, 65; J. Soc. Chem. Ind., **19**, 854; J. Chem. Soc. (Lond.), **78**, 690; School Mines Quart., **22**, 94.

Determination by oxidation to permanganic acid by means of bismuth tetroxide and titration with hydrogen peroxide.

1900: 11. PATTINSON, J., and H. S. Note on the Determination of Manganese as Sulphide.

Chem. News. **81**, 193; J. Chem. Soc. (Lond.), **78**, 443; Chem. Centrbl., **1900**, a, 1244.

Discussion of the incomplete precipitation as sulphide.

1900: 12. TRUCHOT, P. Analyse des cuivres et des mattes industrielles.

Ann. chim. anal. appl., **5**, 442.

Separation from cobalt and nickel, and determination by precipitation as manganese ammonium phosphate. Determination in commercial copper.

SUBJECT INDEX.

QUANTITATIVE DETERMINATION OF MANGANESE.

(A) BY GRAVIMETRIC METHODS.

(3) electrolysis—*Continued.*
1882: 10 Keiser
1883: 18 Schucht
1884: 4 Classen
1884: 17 Wieland
1885: 4 Classen
1886: 18 Moore
1889: 3 Brand
1889: 7 Kohn and Woodgate
1889: 18 Smith and Fränkel
1891: 13 Luckow
1892: 18 Rüdorff
1892: 21 Warwick
1893: 14 Rüdorff
1894: 2 Classen
1894: 16 Thomälen
1895: 5 Engels
1895: 6 Engels
1895: 16 Neumann
1896: 6 Engels
1897: 7 Engels
1898: 13 Kaeppel
1898: 21 Wolman
1900: 4 Hiorns

(4) hydrogen peroxide.
1877: 19 Rosenthal
1884: 7 Hanowsky
1886: 16 Müller
1887: 7 Donath and Zeller
1888: 11 Moore
1889: 15 Radau
1890: 4 Carnot
1893: 2 Carnot
1894: 4 Jones
1899: 7 Friedheim and Brühl

(5) hypochlorites.
1866: 4 Reichardt
1875: 1 Boussingault
1877: 11 Kern

(6) lead peroxide in neutral solution.
1852: 2 Gibbs
1853: 9 Parkinson
1860: 7 Rose
1879: 14 Volhard

(7) potassium chlorate.
1877: 10 Hannay
1879: 1 Beilstein and Jawein
1881: 1 Beilstein and Jawein
1881: 8 Ford
1882: 16 Troilius
1884: 9 Holthof
1887: 18 ———
1893: 9 Jean
1895: 7 Forestier
1896: 11 Mignot
1896: 17 Viard
1900: 8 Joüet
1900: 9 McKenna

(c) manganese ammonium phosphate.
1867: 3 Gibbs
1870: 11 Talbott
1871: 6 Tamm
1872: 1 Allen
1872: 3 Fresenius
1873: 2 Gibbs
1877: 1 Bolton
1877: 14 Munroe
1881: 8 Ford
1884: 3 Bloxam
1887: 2 Bayley
1887: 3 Blair
1888: 10 Meineke
1890: 3 Boyd
1890: 12 McKenna
1893: 9 Jean
1894: 13 Saniter
1896: 5 Dudley
1896: 11 Mignot
1898: 8 Gooch and Austin
1899: 5 Dunnington
1900: 1 Böttger
1900: 2 Dakin
1900: 8 Joüet
1900: 12 Truchot

(d) manganous hydroxide.
1856: 1 Gurlt
1875: 2 Kern
1876: 4 Kern

(e) oxalate.
1870: 2 Gibbs
1870: 3 Leison
1872: 3 Fresenius
1877: 3 Classen
1877: 7 Classen

(f) sulphide.
1821: 2 Pfaff

III. By the method of

(a) Classen (oxalate).

1877: 3 Classen
1877: 7 Classen
1894: 9 Nass

(b) Ford.

1881: 5 Deshayes
1881: 8 Ford
1896: 5 Dudley
1896: 14 Rürup

(c) Gibbs (pyrophosphate).

1867: 3 Gibbs
1871: 6 Tamm
1872: 1 Allen
1877: 1 Bolton
1890: 12 McKenna

(d) Rüdorff.

1892: 18 Rüdorff
1895: 8 Gröger

(e) Wolff.

1883: 22 Wolff
1885: 14 Mathesius
1885: 17 Reinhardt
1885: 18 Reinhardt
1886: 27 Wolff
1891: 5 Chemiker - Commission
1893: 11 Kosman

IV. By miscellaneous methods.

(a) by difference.

1877: 18 Riley
1879: 7 Ledebur
1884: 2 Atkinson
1884: 8 Holdich
1885: 7 Diehl
1888: 21 ———

(b) by dry assay.

1872: 11 Tamm
1896: 3 Büttgenbach

(c) from oxygen absorbed by alkaline solutions.

1864: 4 Mittenzwey

(B) BY VOLUMETRIC METHODS.

I. By titration with potassium permanganate solution.

(a) Direct titration.

1863: 2 Guyard
1864: 6 Winkler
1865: 3 Habich
1872: 3 Fresenius
1878: 4 Morawski and Stingl
1879: 14 Volhard
1880: 5 Haswell
1880: 7 v. Jüptner
1881: 6 Donath
1881: 7 Emmerton
1881: 15 Särnström
1883: 6 v. Jüptner
1883: 11 Meineke
1883: 14 Särnström
1883: 15 Särnström
1883: 17 Schöffel and Donath
1883: 23 Zulskowsky
1884: 1 Anger
1884: 6 Gmelin
1884: 15 Meineke
1884: 18 Wolff
1885: 18 Reinhardt
1885: 20 Wolff
1886: 23 Reinhardt
1886: 27 Wolff
1886: 28 Zimmermann
1887: 4 Brand
1887: 9 Jolles
1888: 4 Ghilian
1891: 2 Blum
1891: 4 Brown
1891: 5 Chemiker - Commission
1891: 9 Hampe
1891: 16 Moldenhauer
1891: 25 Rubricius
1891: 26 Rürup
1892: 1 Aller
1892: 4 Campredon
1892: 7 Donath
1892: 12 v. Reis
1892: 16 Rubricius
1892: 17 Rubricius
1893: 1 Carnot
1893: 6 Gorgeu
1893: 9 Jean
1894: 13 Saniter
1894: 14 Seeliger
1895: 2 Auchy
1895: 18 Thomas

(e) potassium chlorate—*Continued.*
1892: 9 Hampe
1892: 13 v. Reis
1893: 9 Jean
1893: 10 Julian
1893: 13 Parry and Morgan
1894: 5 Jones
1895: 2 Auchy
1895: 7 Forestier
1895: 19 Ulzer and Brüll
1896: 5 Dudley
1896: 14 Rürup
1897: 9 Julian
1898: 6 Ford and Bregowsky
1898: 14 Lehnkering
1899: 16 J. T.
1900: 6 Ibbotson and Brearley

(f) reduction of manganate by alcohol.
1890: 13 Myhlertz

(g) sodium chlorate.
1898: 9 Gooch and Austin
1899: 8 Herting

Solution of the peroxide with the aid of

(a) antimonious chloride.
1872: 5 Kessler
1872: 6 Kessler
1879: 6 Kessler
1879: 7 Ledebur

(b) arsenious oxide.
1898: 9 Gooch and Austin

(c) ferrous salts or oxalic acid.
1853: 4 Hempel
1877: 10 Hannay
1879: 9 Pattinson
1879: 10 Pattinson
1880: 13 Pattinson
1880: 16 Weldon
1880: 18 Wright and Menke
1881: 18 Williams
1883: 4 Hampe
1883: 9 Mackintosh
1883: 13 Raimond
1883: 19 Stone
1883: 20 Stone
1883: 21 Troilius
1884: 11 Ledebur
1884: 12 Mackintosh
1885: 3 Cheever
1885: 10 Hampe
1885: 15 Meineke
1886: 1 Atkinson
1887: 13 Lax
1887: 14 Meineke
1887: 15 Meineke
1887: 17 Reinhardt
1888: 2 Carnot
1888: 7 Julian
1888: 13 Reinhardt
1889: 12 McCulloch
1890: 2 van Bemmeln
1890: 13 Myhlertz
1891: 4 Brown
1891: 5 Chemiker - Commission
1891: 9 Hampe
1891: 19 Norris
1891: 23 v. Reis
1891: 28 Ukena
1892: 2 Bastin
1892: 5 Chemiker - Commission
1892: 9 Hampe
1892: 13 v. Reis
1893: 2 Carnot
1893: 9 Jean
1893: 12 Low
1893: 13 Parry and Morgan
1894: 4 Jones, H. C.
1894: 5 Jones, J.
1895: 2 Auchy
1895: 4 Carnot
1895: 7 Forestier
1895: 18 Thomas
1895: 19 Ulzer and Brüll
1896: 5 Dudley
1896: 14 Rürup
1898: 6 Ford and Bregowsky
1898: 14 Lehnkering
1899: 16 J. T.

(d) hydrochloric acid (Bunsen).
1861: 4 Möller
1886: 2 Barlow

(e) hydrogen peroxide.
1893: 10 Julian

(f) **Hampe**—*Continued.*
1886: 23 Reinhardt
1886: 24 Schöffel and Donath
1887: 13 Lax
1887: 15 Meineke
1888: 13 Reinhardt
1891: 5 Chemiker - Commission
1891: 23 v. Reis
1892: 5 Chemiker - Commission
1892: 9 Hampe
1892: 13 v. Reis
1894: 5 Jones, J.
1895: 19 Ulzer and Brüll
1896: 14 Rürup

(g) **Kessler.**
1872: 5 Kessler
1872: 6 Kessler
1879: 6 Kessler
1887: 13 Lax

(h) **Leclerc.**
1872: 7 Leclerc
1881: 9 Forguignon
1885: 19 Schlagdenhauffen

(i) **Lenssen.**
1860: 3 Lenssen.
1864: 2 Fresenius

(j) **Meineke.**
1883: 10 Meineke
1883: 11 Meineke
1885: 15 Meineke
1886: 15 Meineke
1886: 17 Müller
1886: 23 Reinhardt
1887: 13 Lax
1891: 5 Chemiker - Commission

(k) **Morawski and Stingl.**
1878: 4 Morawski and Stingl
1884: 15 Meineke

(l) **Pattinson.**
1879: 9 Pattinson
1880: 18 Wright and Menke
1884: 11 Ledebur
1886: 1 Atkinson
1886: 20 Pattinson
1887: 13 Lax
1891: 21 Pattinson
1893: 9 Jean
1894: 13 Saniter

(m) **Reinhardt.**
1888: 13 Reinhardt
1891: 5 Chemiker - Commission

(n) **Rössler.**
1879: 13 Rössler
1880: 15 Rössler
1894: 14 Seeliger

(o) **Rürup.**
1891: 2 Blum
1891: 25 Rubricius
1891: 26 Rürup

(p) **Särnström.**
1881: 15 Särnström
1883: 7 Kerl
1883: 15 Särnström
1890: 6 Hellman
1896: 12 Mixer and Dubois
1897: 1 Auchy

(q) **Schneider.**
1889: 17 Schneider
1895: 17 Reddrop and Ramage
1898: 4 Campredon

(r) **Schöffel and Donath.**
1883: 14 Särnström
1883: 17 Schöffel and Donath
1886: 24 Schöffel and Donath
1887: 13 Lax
1891: 5 Chemiker - Commission

(s) **Volhard.**
1879: 14 Volhard
1880: 5 Haswell
1880: 7 v. Jüptner
1881: 7 Emmerton
1882: 8 Haswell
1883: 6 v. Jüptner
1883: 11 Meineke
1884: 6 Gmelin
1884: 11 Ledebur
1884: 15 Meineke
1887: 9 Jolles
1888: 6 Iles
1891: 2 Blum
1891: 4 Brown
1891: 16 Moldenhauer

(b) lead peroxide—*Continued.*

1887: 5 Cheever
1887: 16 Morgan
1893: 13 Parry and Morgan
1895: 7 Forestier
1896: 1 Auchy
1896: 11 Mignot
1897: 11 Lemaire
1897: 15 Schneider
1898: 18 Pichard

II. By the formation of metaphosphate.

1885: 16 Osmond
1891: 24 Rossi

III. By the formation of manganate.

1873: 1 Brünner
1874: 1 Koppmayer

IV. By the liberation of iodine.

1874: 2 Morrell
1875: 4 Morrell

(D) GENERAL DISCUSSION OF METHODS.

1875: 1a Bolton
1881: 11 Kent
1882: 6 Dunn
1882: 15 Tamm
1883: 16 Schmitt
1884: 13 Mackintosh
1884: 16 Stone
1885: 19 Schlagdenhauffen
1887: 13 Lax
1888: 10 Meineke
1889: 4 Finkener
1891: 21 Pattinson
1894: 13 Saniter
1895: 15 v. Juptner
1895: 16 Neumann
1896: 1 Auchy
1896: 4 Dewey
1896: 10 v. Juptner
1896: 14 Rurup
1897: 15 Schneider
1898: 13 Kaeppel (electrolytic)
1898: 21 Wolman (electrolytic)
1899: 3 Brearley

(E) SEPARATION FROM OTHER ELEMENTS.

(a) from alkaline earths.

1852: 2 Gibbs
1853: 9 Parkinson
1861: 4 Möller
1886: 2 Barlow

(b) from aluminum.

1860: 6 Rose
1865: 2 Gibbs
1865: 5 Rube
1879: 4 Classen
1879: 14 Volhard
1881: 3 Classen
1899: 9 Hess and Campbell

(c) from arsenic.

1837: 4 Sheerer
1895: 13 Jannasch and Kammerer

(d) from cadmium.

1889: 3 Brand
1891: 27 Smith
1892: 21 Warwick
1895: 14 Jannasch and Röttgen

(e) from calcium.

1827: 3 Stromeyer
1860: 6 Rose
1877: 4 Classen
1889: 2 Blum
1889: 16 Reitmar
1892: 14 Riggs

(f) from cerium.

1864: 3 Gibbs

(g) from chromium.

1865: 2 Gibbs
1884: 5 Classen
1894: 6 Kassner
1894: 11 Poleck
1895: 10 Jannasch and Cloedt
1898: 3 Brearley
1899: 7 Friedheim and Brühl

(h) from cobalt by means of

(1) chlorine.

1866: 5 Terreil

(2) citrates.

1892: 10 Moore

(1) acetates—*Continued.*
1880: 4 Dunston
1880: 6 Jewett
1881: 11 Kent
1881: 17 Troilius
1882: 2 Cabot
1882: 4 Dewey
1882: 9 Jewett
1884: 3 Bloxam
1886: 1 Atkinson
1886: 12 Deane
1886: 16 Müller
1886: 22 Reinhardt
1886: 26 Sprenger
1887: 18 ———
1888: 4 Ghilian
1888: 10 Meineke
1888: 14 v. Reis
1888: 21 ———
1889: 9 Mayer (qualitative)
1892: 4 Campredon
1892: 11 Priwoznik
1892: 14 Riggs
1893: 9 Jean
1893: 11 Kosman
1893: 13 Parry and Morgan
1895: 7 Forestier
1897: 3 Brearley
1897: 4 Brearley
1899: 2 Brearley
1900: 8 Jouet
1900: 9 McKenna

(2) ammonia in the presence of ammonium chloride.
1813: 1 Hatchett
1830: 2 Fuss
1876: 4 Kern

(3) arsenates.
1827: 1 Du Menil
1827: 2 Quesneville
1829: 3 Martini

(4) benzoic acid.
1806: 1 Berzelius
1812: 1 Pfaff
1829: 3 Martini
1836: 2 Thomson
1877: 9 Funaro

(5) camphoric acid.
1832: 5 Kastner

(6) chlorate.
See "precipitation by means of chlorate." See pp. 98 and 101

(7) chlorides.
1797: 1 Kirwan
1837: 4 Scheerer
1863: 3 Lippert

(8) chlorine.
1853: 12 Schiel
1861: 4 Möller

(9) electrolysis.
1830: 1 Becquerel
1881: 2 Classen
1881: 3 Classen and v. Reis
1882: 10 Keiser
1885: 5 Classen
1886: 10 Classen
1886: 11 Classen
1888: 12 Oettel
1889: 7 Kohn and Woodgate
1891: 15 Le Roy
1896: 6 Engels
1898: 5 Engel

(10) ether.
1892: 15 Rothe

(11) fusion with alkali and nitrate.
1833: 2 Planiawa
1894: 14 Seeliger

(12) ferrocyanide.
1886: 5 Blum

(13) hydrogen peroxide.
1888: 11 Moore

(14) iodine.
1879: 1 Beilstein and Jawein
1881: 1 Beilstein and Jawein

(15) a magnet after ignition in hydrogen.
1875: 2 Kern

(16) neutralization with carbonates.
1799: 1 Vauquelin
1812: 1 Pfaff
1821: 1 Herschell
1831: 1 Fuchs
1831: 2 Liebig
1832: 2 Döbereiner
1832: 6 Liebig
1834: 1 Demarçay

(m) from magnesium—*Continued.*
1868: 4 Terreil
1869: 2 Damour
(n) from mercury.
1886: 11 Classen and Ludwig
1889: 3 Brand
1894: 12 Rüdorff
1895: 9 Jannasch and Cloedt
1898: 12 Jannasch and Alffers
(o) nickel, by means of
(1) ammonium carbonate.
1872: 10 Tamm
(2) atmospheric oxygen.
1881: 4 Delvaux
(3) chlorine.
1853: 12 Schiel
1866: 5 Terreil
(4) electrolysis
1886: 14 Langbein
1886: 19 Moore
1889: 3 Brand
1891: 15 Le Roy
1896: 6 Engels
1898: 5 Engels
(5) hypochlorites, hydrofluoric acid, and ammonia.
1841: 4 Ullgren
(6) mercuric oxide.
1835: 2 Persoz
(7) peroxides.
1852: 2 Gibbs
1853: 9 Parkinson
1860: 7 Rose
1886: 2 Barlow
1887: 7 Donath and Zeller
1891: 10 Jannasch and Franzek
1893: 5 Clark
1896: 9 Jannasch and Lehnert
1899: 7 Friedheim and Brühl
(8) phosphates.
1858: 2 Henry
1900: 12 Truchot
(9) potassium permanganate.
1866: 5 Terreil
(10) through the solubilities of the sulphides.
1838: 2 Wackenroder
1847: 3 Rose
1849: 1 Ebelmen
1863: 3 Lippert
1865: 2 Gibbs
1866: 3 Frohde
1886: 6 Carnot
1886: 26 Sprenger
1888: 11 Moore
1890: 5 Fresenius and Hintz
1894: 3 Fleitmann
1897: 8a Hillebrand
1900: 3 Hillebrand
(11) (method not indicated.)
1882: 14 Mills and Becket
(p) from phosphoric acid.
1881: 2 Classen
(q) from silica.
1886: 12 Deane
1898: 6 Ford and Bregowsky
(r) from silver.
1895: 12 Jannasch and Kammerer
(s) from thallium.
1864: 1 Crookes
(t) from tin.
1853: 7 Löwenthal.
1861: 6 Rose
(u) from tungstic acid.
1896: 16 Taggart and Smith
(v) from vanadium.
1889: 15 Radau
(w) from zinc by means of
(1) carbonate.
1872: 10 Tamm
1879: 3 Classen
(2) acetic acid.
1788: 1 Porcel
1837: 3 Richter
1886: 4 Bein
(3) ammonium sulphocarbonate
1882: 7 Guyard
(4) ammonium sulphocyanate.
1880: 20 Zimmermann
(5) bromine
1869: 3 Galetti
1892: 3 Blum
(6) cyanides.
1853: 2 Flajalot
(7) electrolysis.
1830: 1 Becquerel.

(11) **irons**—*Continued.*
1886: 26 Sprenger
1887: 1 Babbitt
1887: 16 Morgan
1887: 18 ———
1887: 19 ———
1888: 13 Reinhardt
1888: 20 Weismann
1888: 21 ———
1890: 6 Hellman
1891: 2 Blum
1891: 4 Brown
1891: 24 Rossi
1891: 25 Rubricius
1892: 12 v. Reis
1892: 17 Rubricius
1893: 10 Julian
1895: 7 Forestier
1895: 19 Ulzer and Brüll
1896: 11 Mignot
1896: 13 Murkewitsch
1896: 14 Rürup
1898: 6 Ford and Bregowsky
1898: 16 Murmann
1899: 8 Herting
1900: 10 Mignot

(12) **iron ores.**
1866: 2 Eggertz
1872: 8 Pichard
1873: 1 Brunner
1874: 1 Koppmayer
1878: 9 Funaro
1877: 9 Ledebur
1879: 9 Pattinson
1879: 10 Pattinson
1883: 23 Zulkowsky
1885: 12 Kalmann and Smolka
1886: 1 Atkinson
1887: 3 Blair
1890: 13 Myhlertz
1891: 19 Norris
1891: 21 Pattinson
1897: 1 Auchy
1898: 6 Ford and Bregowsky

(13) **manganese bronze.**
1894 5 Jones

(14) **manganese phosphides.**
1897 8 Granger

(15) **manganic acid.**
1824: 1 Frommherz

(16) **meteorites.**
1879: 12 Pellitz

(17) **mineral or sea waters.**
1841: 2 Henry
1876: 2 Fresenius
1889: 5a Gooch and Whitfield
1899: 11 Natterer

(18) **plants.**
1897: 11 Lemaire
1898: 18 Pichard

(19) **Pyrolusite (and other manganese ores)** See "Quantitative Determination of Manganese Peroxide."

(20) **slags or silicates.**
1881: 10 Iles
1883: 8 Knop
1884: 10 Iles
1888: 6 Iles
1889: 5 Friedburg
1890: 13 Myhlertz
1891: 19 Norris
1891: 20 Namias
1900: 3 Hillebrand

(21) **soils.**
1890: 2 van Benmeln
1897: 2 van Benmeln
1898: 18 Pichard

(22) **spiegeleisen.**
1870: 4 Parker
1870: 8 Rowan
1874: 4 Parry
1874: 6 Willis
1875: 2 Kern
1875: 4 Morrell
1876: 3 Galbraith
1877: 8 Deby
1877: 12 Kern
1877: 18 Riley
1877: 20 Stöckmann
1878: 2 Deshayes
1879: 6 Kessler
1879: 9 Pattinson
1879: 10 Pattinson
1881: 8 Ford
1883: 19 Stone
1884: 2 Atkinson
1884: 3 Bloxam

(g) Filtration aided by addition of a concentrated solution of sodium acetate.
1888: 16 Schürmann

(h) Destruction of organic matter by means of barium peroxide before titration with permanganate.
1887: 4 Brand
1892: 12 v. Reis

(i) Determination of moisture in the analysis of pyrolusite.
1855: 3 Fresenius

(j) Use of hydrofluoric acid to hold silicic acid in solution.
1891: 19 Norris
1898: 6 Ford and Bregowsky
1900: 5 Ibbotson and Brearley.

QUANTITATIVE DETERMINATION OF MANGANESE PEROXIDE.

I. By evolution of chlorine, and absorption in solutions of

(a) alkaline hydroxides and determination of the hypochlorite formed.
1829: 1 Gay-Lussac
1835: 1 Gay-Lussac
1844: 1 Ettling
1869: 10 Sherer and Rumpf
1870: 10 Sherer and Rumpf
1870: 12 Tissandier
1877: 16 Perrey

(b) arsenious acid.
1853: 10 Price
1860: 4 Machnea

(c) ferrous sulphate.
1831: 3 Turner
1842: 4 Otto
1867: 1 Braun
1868: 3 Lunge
1869: 8 Prior
1885: 2 Charpentier

(d) potassium iodide, and titration of iodine.
1853: 1 Bunsen
1853: 5 Krieger
1861: 4 Möller
1869: 10 Sherer and Rumpf
1870: 1 Fresenius
1870: 5 Pattinson
1870: 10 Sherer and Rumpf
1877: 15 Parreño
1877: 16 Perrey
1879: 11 Pickering
1881: 13 Lunge
1888: 9 de Koninck and Lecrenier

(e) silver nitrate.
1843: 1 Baumann

(f) stannous chloride.
1851: 2 Müller

(g) sulphurous acid (precipitation of barium sulphate).
1832: 3 Duflos
1832: 4 Duflos
1837: 2 Ebelmen
1838: 1 Gieseler
1874: 5 Pouchet

II. By solution in presence of a reducing agent.

(a) antimonious chloride.
1872: 5 Kessler

(b) arsenious acid.
1898: 2 Bialobszcski

(c) ferrous salts.
1842: 2 Levol
1847: 2 Levol
1851: 4 Schabus
1856: 2 Schreiner
1869: 11 Teschenmacher and Smith
1870: 5 Pattinson
1877: 10 Hannay
1880: 11 Lunge
1881: 16 Terreil
1889: 4 Finkener
1889: 10 M'Kellar

(d) formic acid (with absorption of carbon dioxide).
1833: 1 Göbel

(e) oxalates (with absorption of carbon dioxide).
1843: 3 Fresenius and Will
1847: 6 De Vry
1861: 2 Kolbe

(d) Lunge (gasometric).
1885: 13 Lunge
1890: 1 Baumann
1890: 9 Lunge
1890: 10 Lunge
1890: 11 Lunge
1893: 3 Carnot
1893: 4 Carnot
1894: 8 Lunge

(e) Nolté.
1859: 2 Nolté
1864: 5 ———

VII. Modification of apparatus for the method of

(a) Bunsen.
1888: 5 de la Harpe and Réverdin
1894: 1 Christomanos
1894: 17 Ullmann

(b) Gay-Lussac.
1847: 1 Bobierre
1878: 5 Morawski and Stingl

(c) Lunge.
1890: 11 Lunge
1894: 7 Kippenberger

(d) loss of weight on evolution of carbon dioxide from oxalic acid.
1898: 17 Northomb

QUALITATIVE DETECTION OF MANGANESE.

Detection by means of

(a) ammonium thiosulphate.
1883: 12 Orlowski

(b) fusion with alkalies.
1785: 1 Hjelm
1836: 1 Kraskowitz
1836: 2 Thomson
1852: 1 Chapman
1854: 1 Davy
1877: 2 Chapman
1889: 19 Wells and Vulté

(c) fusion with silica and the alkalies.
1878: 1 Bong

(d) blow-pipe bead tests.
1820: 1 Gahn

(e) blow-pipe reactions.
1866: 1 Bunsen
1877: 2 Chapman

(f) bromate or bromine.
1897: 5 Cushman
1898: 20 Vitali

(g) hydrogen peroxide.
1888: 8 Klein
1889: 6 Klein

(h) formation of metaphosphate.
1815: 1 John

(i) microchemical tests.
1886: 3 Behrens
1887: 8 Haushofer
1891: 1 Behrens
1892: 8 Frey
1899: 12 Pozzi-Escot

(j) oxidation to permanganic acid.
1845: 2 Crum
1852: 2 Gibbs
1853: 3 Heizel
1853: 6 Löwe
1858: 3 Rose
1870: 7 Polacci
1883: 2 Guyard
1884: 14 Maumené
1886: 7 Christensen
1895: 1 Alvarez and Jean
1898: 19 Pichard

(k) ozone.
1847: 5 Schönbein

(l) phosphoric acid.
1846: 2 Phillips
1857: 1 Barreswil
1859: 3 Von Kobell
1867: 1 Braun
1876: 1 Campani
1881: 14 v. Reis
1885: 1 Bloxam

(m) fusion with potassium chlorate.
1857: 2 Böttger
1872: 2 Böttger
1880: 1 Böttger

(n) potassium ferricyanide.
1885: 6 Dean
1885: 8 Draper

(o) potassium ferrocyanide.
1850: 1 Davy

AUTHOR INDEX.

Gmelin, O., 1884: 6
Göbel, 1833: 1
Goetz, 1883: 1
Gooch, F. A., and Austin, M., 1898: 7; 1898: 8; 1898: 9
Gooch, F. A., and Whitfield, J. E., 1889: 5a
Gorgeu, A., 1860: 2; 1893: 6
de Gramont, A., 1898: 10
Granger, A., 1897: 8
Gröger, M., 1895: 8
Grotthuss, T., 1817: 1
Gurlt, A., 1856: 1
Guyard, A., 1863: 2; 1882: 7; 1883: 2

Habich, R., 1865: 3
Hambly, F. J. See Thorpe and Hambly.
Hampe, W., 1883: 4; 1885: 9; 1885: 10; 1891: 8; 1891: 9; 1892: 9
Handy, J. O., 1896: 7a
Hannay, J. B., 1877: 10
Hanowsky, 1884: 7
de la Harpe, C., and Réverdin, F., 1888: 5
Harvey, J. W. C., 1883: 3
Haswell, A. E., 1880: 5; 1882: 8
Hatchett, 1813: 1
Haushofer, 1887: 8
Heizel, 1853: 3
Hellman, C. G., 1890: 6
Hempel, W., 1853: 4; 1858: 1; 1883: 5; 1893: 7
Henry, T. H., 1841: 2; 1858: 2
Hermbstädt, 1792: 1
Herschell, J. F. W., 1821: 1
Herting, O., 1899: 8
Hess, W. H., and Campbell, E. D., 1899: 9
Heyl, P. See Smith and Heyl.
Hillebrand, W. F., 1897: 8a; 1898: 11; 1900: 3
Hintz, E. See Fresenius and Hintz.
Hiorns, A., 1900: 4
Hjelm, P. J., 1785: 1
Holdich, 1884: 8
Holthoff, C., 1884: 9
Horner, 1872: 4
How, 1869: 4.
Hunt, A. E., 1886: 13
Ibbotson, F., and Brearley, H., 1900: 5 1900: 6
Iles, M. W., 1881: 10; 1884: 10; 1888: 6

Jannasch, P., 1896: 8
Jannasch, P., and Alffers, F., 1898: 12
Jannasch, P., and v. Cloedt, E., 1895: 9 1895: 10; 1895: 11
Jannasch, P., and Franzek, C. J., 1891: 10
Jannasch, P., and Kammerer, H., 1895: 12; 1895: 13
Jannasch, P., and Lehnert, H., 1896: 9
Jannasch, P., and MacGregory, J. F., 1891: 11
Jannasch, P., and Niederhofheim, 1891: 12
Jannasch, P., and Röttgen, A., 1895: 14
Jawein, L. See Beilstein and Jawein.
Jean, F., 1893: 8; 1893: 9. See also Alvarez and Jean.
Jensch, E., 1890: 7
Jervis, H., 1900: 7
Jewett, J., 1880: 6; 1882: 9
John, J. F., 1806: 2; 1815: 1
Jolles, A., 1887: 9
Jones, H. C., 1894: 4; 1894: 5
Joüet, C. H., 1900: 8
Juette, M., 1868: 2
Julian, F., 1888: 7; 1893: 10; 1897: 9
v. Jüptner, H., 1880: 7; 1883: 6; 1885: 11; 1895: 15; 1896: 10
Jurisch, K., 1880: 8

Kaeppel, F., 1898: 13
Kalmann, W., and Smolka, A. 1885: 12
Kammerer, H., 1871: 3. See also Jannasch and Kammerer.
Kassner, O., 1894: 6.
Kastner, 1832: 5
Keiser, E. H., 1882: 10
Kent, W., 1881: 11
Kerl, B., 1883: 7
Kern, S., 1875: 2; 1876: 4; 1877: 11; 1877: 12
Kessler, F., 1872: 5; 1872: 6; 1879: 6
Kirwan, 1797: 1

Müller, F. C. G., 1878: 6
Müller, L., 1855: 2
Munroe, C. E., 1877: 14
Murkewitsch, M., 1896: 13
Murmann, E., 1898: 15; 1898: 16
Myhlertz, F. G., 1890: 13

Namias, R., 1891: 20; 1899: 10
Nass, G., 1894: 9
Natterer, K., 1899: 11
Neumann, B., 1895: 16; 1896: 13a
Neumann, G., 1889: 14; 1894: 10
Niederhofheim. See Jannasch and Niederhofheim.
Nolté, G., 1859: 2
Norris, G. L., 1891: 19
Northomb, M., 1898: 17

Oettel, F., 1888: 12
Orlowski, A., 1883: 12
Osmond, 1885: 16
Otto, 1842: 3; 1842: 4

Parker, J. S., 1870: 4
Parkinson, 1853: 9
Parreño, A. G., 1877: 15
Parry, J., 1874: 4
Parry, J., and Morgan, J. J., 1893: 13
Parry, J., and Tucker, A. E., 1880: 12
Pattinson, J., 1870: 5; 1879: 9; 1879: 10; 1880: 13; 1886: 20
Pattinson, J., and H. S., 1891: 21; 1900: 11
Paul, B. H., 1870: 6
Pellitz, W., 1879: 12
Perillou, 1886: 21
Perrey, 1877: 16
Personne and Lhermite, 1851: 3
Persoz, J., 1835: 2
Peters, S., 1876: 5
Pfaff, C. H., 1812: 1; 1819: 3; 1821: 2
Phillips, R., 1846: 2
Phipson, T. L., 1876: 6
Pichard, P., 1872: 8; 1898: 18; 1898: 19
Pickering, S. U., 1879: 11
Piesse, C. H., 1874: 3
Planiawa, 1833: 2
Poleck, T., 1894: 11
Pollacci, E., 1870: 7
Porcel, 1788: 1
Post, J., 1880: 14
Pouchet, A. G., 1874: 5
Pozzi-Escot, M. E., 1899: 12
Price, 1853: 10
Prior, M. E., 1869: 8
Priwoznik, 1892: 11
Prochaska, J., 1878: 7
Purgotti, A., 1897: 14

Quadrat, B., 1861: 5
Quesneville, Jr., 1827: 2

Radau, C., 1889: 15
Raimond, E., 1883: 13
Ramage, H. See Reddrop and Ramage.
Reddrop, J., and Ramage, H., 1895: 17
Regelsberger, F., 1891: 22
Reichard, C., 1899: 13; 1899: 14
Reichardt, E., 1866: 4
Reinhardt, C., 1885: 17; 1885: 18; 1886: 22; 1886: 23; 1887: 17; 1888: 13
v. Reis, M. A., 1881: 14; 1888: 14; 1891: 23; 1892: 12; 1892: 13. See also Classen and v. Reis.
Reitmair, O., 1889: 16
Renard, A., 1869: 9
Réverdin, F. See de la Harpe and Réverdin.
de Rezende, 1872: 9
Riban, J., 1890: 14
Riche, A., 1878: 8
Riche, M. A., 1877: 17
Richter, 1796: 1
Richter, W., 1837: 3
Riederer, E. J., 1899: 15
Riggs, R. B., 1892: 14
Riley, E., 1877: 18
Rinmann, S., 1786: 1
Rivot, 1853: 11
Röhr, R., 1862: 2
Rose, H., 1847: 3; 1858: 3; 1860: 5; 1860: 6; 1860: 7; 1861: 6
Rosenthal, G., 1877: 19
Rossi, A. J., 1891: 24
Rössler, C., 1879: 13; 1880: 15

SMITHSONIAN MISCELLANEOUS COLLECTIONS.

1314

CHEMICAL SOCIETIES

OF THE

NINETEENTH CENTURY.

BY

HENRY CARRINGTON BOLTON.

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CHEMICAL SOCIETIES OF THE XIX CENTURY.*

By Henry Carrington Bolton, Ph.D.

The beginning of a new century affords an opportune period for chronicling the progress of chemistry as shown by the organizations formed to foster its study and to stimulate its adherents. In the following pages an attempt has been made to place on record the statistics of the Chemical Societies of the World for the year 1900, and to indicate those that ended their careers within the nineteenth century. The data have been obtained chiefly by correspondence, and thanks are due to the officers of societies who have responded to inquiries. I am also under special obligations to Dr. Paul Dorveaux, Librarian of the École Supérieure de Pharmacie, Paris; to Professor Bohuslav Brauner, of the Bohemian University, Prague; to Professor George W. A. Kahlbaum, of the University of Basel; and particularly to the Smithsonian Institution, for aid in securing the information sought.

The fact that chemical societies were organized and in operation in the United States of America long before they existed in Europe has been shown in my paper, "Early American Chemical Societies," read to the Chemical Society of Washington, April 8, 1897. The two pioneers in this field were the "Chemical Society of Philadelphia," founded in 1792, and the "Columbian Chemical Society of Philadelphia," founded in 1811. Of these some particulars will be found in their proper order.

In the following list the societies are placed in chronological order under each country, and the countries are arranged alphabetically. Of each society the following data are given so far as attainable:

Seat, and date of founding,
Name of President, and membership in 1900,†
Serial publications,‡
Remarks.

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* Read at the 25th Anniversary of the American Chemical Society held in New York City, April 12–13, 1901.

† No deductions have been made for duplication.

‡ For full details consult: A Select Bibliography of Chemistry, by Henry Carrington Bolton, Washington, 1893–1899. 3 vols. 8vo.

The results of this census are given in the following Table:

CHEMICAL SOCIETIES OF THE WORLD.

MEMBERSHIP IN 1900.

Country.	*No. of Societies.*	*No. of Members.*
Austria	7	3,072
Belgium	3	740
France	10	4,065
Germany	10	7,559
Great Britain	9	7,550
Italy	5	479
Japan	2	1,012
Russia	1	327
South Africa	1	(?)
Switzerland	2	94
United States America	5	2,379
Victoria	1	100
TOTALS	56	27,377

March, 1901.
WASHINGTON, D. C.

AUSTRIA.

Centralverein für Rübenzucker Industrie in der oesterreichisch-ungarischen Monarchie.

Founded in 1854 at Vienna. In 1900: President, August Freiherr von Stummer; members, 213; associates, 49.

Publications: Organ des Vereins für R.-I., 1863–1874; Organ des Centralvereins für R.-I., 1875–1887; Oesterreichisch-ungarische Zeitschrift für Zucker-Industrie und Landwirthschaft, 1888–1900. (Beilagen): Der Marktbericht, 1874–1885; Wochenschrift des Centralvereins für Rübenzucker in der oesterreichisch-ungarischen Monarchie, 1886–1900.

Note.—The Society maintains a Chemical Experiment Station under the direction of F. Stohmer.

Verein zur Hebung der Zuckerfabrikation im Königreich Böhmen. [Also with a Bohemian name.]

Founded in 1868 at Prag under the presidency of Ferdinand Urbánek; the languages used were Bohemian and German. It was disbanded in 1874.

Publication: Zeitschrift für Zucker-Industrie. Organ des Vereins. Prag. 3 vols., 1872–74.

Note.—This journal is not to be confounded with: Zeitschrift für Zucker-Industrie in Böhmen, established at Prag in 1877 and current.

Chemicka Společnost: Spolek Českých chemiků. [Chemical Society: Union of Bohemian Chemists.]

Founded in 1872 at Prag. In 1900: President, K. Preis; honorary members, 11; active members, 318; correspondents, 77.

Publications: Zprávy spolku českých chemiků. 2 vols., 1872–76. (Reports.) Listy Chemické, 1877–1900. (Letters.)

Note.—The Society has also published a Chemická Knihovna (Chemical Library) in 8 vols.

Zemsky spolek pro průmysl cukrovarnický v Čechách; Verein der Zuckerindustrie im Königreich Böhmen.

Founded in 1876 at Prag. In 1900: President, Gustav Hodek; members, 325.

Publications: Zeitschrift für Zucker-Industrie in Böhmen, 1877–1900. (Beilage): Prager Zuckermarkt, 1881–1900.

Oesterreichische Gesellschaft zur Förderung der chemischen Industrie.

Founded in 1878 at Prag. In 1900: President, Georg Zetter; honorary members, 3; members, 196.

Publications: Bericht der oesterreichischen Gesellschaft zur Förderung der chemischen Industrie, 1879–98. Since 1899 the organ of the Society is: Oesterreichische Chemiker-Zeitung.

Společnost pro průmysl chemický. [Society of Chemical Industry.]

Founded in 1892 at Prag. In 1900: President, J. B. Lambl; honorary members, 20; active members, 440; correspondents, 54; founders, 57.

Publications: The organ of the Society since 1892 is: Časopis pro průmysl chemický, of Prag, which had been established in 1891. The Society has also published three volumes of a technological library: Knihovna technologicko chemická.

Wiener Verein zur Förderung des physikalischen und chemischen Unterrichts.

Founded in 1895 at Vienna. In 1900: President, Victor von Lang; members, 317.

Publication: Vierteljahrsberichte der Wiener Verein zur Förderung des physikalischen und chemischen Unterrichts, 1895–1900.

Verein oesterreichischer Chemiker in Wien.

Founded in 1897 at Vienna. In 1900: President, J. Klaudy; members, 878; founders, 14.

Publication: Oesterreichische Chemiker Zeitung, 1898–1900.

BELGIUM.

Association Belge des Chimistes.

Founded August 4, 1887, at Brussels. In 1900: President, L. L. de Koninck; honorary members, 4; active members, 482; associates, 21; correspondents, 8.

Publication: Bulletin de l'Association Belge des Chimistes, 1887–1900.

Note.—The Association has 8 sections, viz: Liége, Louvain, Gembloux, Charleroi, Mons, Gans, Antwerp, Brussels.

Société technique et chimique de sucrerie de Belgique.

Founded February 26, 1896, at Brussels. In 1900: President, Eugène Meeus; members, 173; patron, 1.

Publications: La sucrerie Belge, which was established August 31, 1872, has been the organ of the Society since its foundation. The Society has also published several pamphlets on technical topics.

Note.—The formation of Sections was under discussion in 1900.

Syndicat des Chimistes publics de Belgique.

Founded in 1897 at Brussels. In 1900: President, François Sachs; members, 51.

Publication: Bulletin du Syndicat des chimistes publics de Belgique, 1897–1900.

Note.—The Society has in preparation: Recueil générale des méthodes d'analyse usitée dans les laboratoires publics.

Société générale des fabricants de sucre de Belgique is not a chemical society; its organ is: La sucrerie Belge, 1872–1900.

FRANCE.

Société industrielle de Mulhouse.

Founded in December, 1825, at Mulhouse (first meeting, May 11, 1826). In 1900: President, Auguste Dollfus; honorary members, 9; resident members, 190; non-resident members, 378; correspondents, 54.

Publication: Bulletin de la Société industrielle de Mulhausen (*sic*), 1827–1900.

Note.—This is not purely a chemical society, but it has a Committee on chemistry, and its Bulletin contains many papers on applied chemistry.

Société chimique de Paris.

Founded June 4, 1857, at Paris. In 1900: President, Edouard Grimaux; members, 365; patrons, 121; life members, 91; corresponding members, 449.

Publications: (*a*) Bulletin des séances de la Société chimique de Paris, 1858–62; (*b*) Répertoire de chimie pure et appliquée, 1858–63; (*c*) Bulletin de la Société chimique de Paris, 1864–1900; (*d*) Conférences et Leçons, 5 vols.

Association des élèves de M. Fremy.

Founded in 1878 at Paris. In 1900: President, Louis Barthélemy; members, 200.

Publication: Bulletin trimestriel de l'Association des élèves de M. Fremy, 1878–1900.

Note.—A social organization which, however, publishes the work of its members.

Association des chimistes de sucrerie et de distillerie de France et des Colonies.

Founded in 1883 at Paris. In 1900: President, M. Durin; honorary members, 3; resident members, 160; non-resident members, 710; corresponding members, 395.

Publication: Bulletin de l'Association des chimistes de sucrerie et de distillerie de France et des Colonies, 1883–1900.

Association amicale des anciens élèves de l'École de physique et de chimie industrielle de la ville de Paris.

Founded in 1885 at Paris. In 1900: President, Octave Boudouard; honorary members, 41; members, 300.

Publication: Bulletin mensuel de l'Association amicale des anciens élèves de l'École de physique et de chimie industrielle de la ville de Paris, 1885–1900. Annuaire [etc.], 1885–1900.

Association amicale des anciens élèves de l'École de chimie industrielle de l'Lyon.

Founded in 1886 at the Institut chimique de Lyon. In 1900: President, Alphonse Seyewitz; honorary members, 6; members, 104.

Publication: Bulletin des séances de l'Association amicale des anciens élèves de l'École de chimie industrielle de Lyon.

Syndicat central des chimistes et essayeurs de France.

Founded in 1890 at Paris. In 1900: President, Ferdinand Jean; members, 125.

Publications: Revue de chimie analytique appliquée à l'industrie, 1893–98. Annales de chimie analytique appliquée à l'industrie became the organ of the Society in 1899; the Annales had been established in 1896, and was united with the Revue (above named) in 1899.

Société chimique du Nord de la France.

Founded at Lille in 1891. In 1900: President, A. Pouriez; members, 100.

Publication: Bulletin mensuel de la Société chimique du Nord de la France, 1891–1900

Association amicale des anciens Élèves de l'Institut chimique de Nancy.

Founded November 9, 1892, at Nancy. In 1900: President, M. Noel; honorary members, 8; patrons, 7; members, 52; associates, 75.

Publication: Bulletin (annuel) de l'Association.

Association amicale des Élèves et anciens Élèves du laboratoire d'Enseignment pratique appliquée de l'université de Paris.

Founded in 1897 at Paris. In 1900: President, M. Loyer; honorary members, 12; members, 110.

Publication: Gazette de chimie, Paris, 1900.

GERMANY.

Verein für die Rübenzucker Industrie im Zollverein [later, des deutschen Reichs; later, Verein der deutschen Zuckerindustrie].

Founded in 1850 at Berlin. In 1900: President, De Coste; members, 447.

Publication: Zeitschrift des Vereins [etc.], 1850–1900.

Deutsche chemische Gesellschaft zu Berlin.

Founded in 1867 at Berlin. In 1900: President, G. Volhard; honorary members, 15; life members, 92; members, 2637; associates, 372.

Publication: Berichte der deutschen chemischen Gesellschaft zu Berlin, 1868–1900. Since 1897 also: Chemisches Centralblatt (established in 1830).

Verein analytischer Chemiker.

Founded in 1878 at Magdeburg, and merged in 1887 with the Deutsche Gesellschaft für angewandte Chemie. *See* Verein deutscher Chemiker.

Publication: Correspondenzblatt des Vereines analytischer Chemiker, 1878–80.

Freie Vereinigung bayerischer Vertreter der angewandten Chemie.

Founded in May, 1883, at Munich. In 1900: President, Albert Hilger; honorary members, 2; members, 124; correspondents, 69.

Publications: Bericht über die 1 [– 18] Versammlung der freien Vereinigung bayerischer Vertreter der angewandten Chemie, 1883–1900. Also reports in: Forschungsberichte über Lebensmittel und ihre Beziehung zur Hygiene, 1894–97: and in: Zeitschrift für Untersuchung der Nahrungs- und Genuss-Mittel, 1898–1900.

Verein deutscher Berufs-Chemiker.

Founded in 1887 at Dresden.

Publication: The "Chemiker und Droguist" (Dresden, 1885) had in 1887 the sub-title: Correspondenzblatt des Vereines deutscher Berufs Chemiker. This title was dropped in 1888.

Deutsche Gesellschaft für angewandte Chemie.

Founded November, 1887, at Berlin, absorbing the Verein analytischer Chemiker. In 1896 the Society became: Verein deutscher Chemiker, *q. v.*

Publication: Zeitschrift für angewandte Chemie, 1888–1900. This was begun as: Zeitschrift für die chemische Industrie in 1887.

Vereinigung öffentlicher analytischer Chemiker Sachsens.

Founded in 1890 at Plauen in Vogtland. In 1900: President, Arthur Forster; members, about 25.

Publication: Zeitschrift für öffentliche Chemie, 1897–1900. Also: Bericht über die Hamptversammlung des Vereines öffentlicher analytischer Chemiker Sachsens.

Verein akademisch-gebildete [later, deutscher] Zuckertechniker.

Founded in 1891 at Berlin. In 1900: President, H. Claassen; honorary members, 1; members, 406; correspondents, 3.

Publication: Zeitschrift des Vereins akademisch-gebildete Zuckertechniker, 1891–92.

Note.—The organ of publication changed several times.

Verband des Laboratoriums-Vorstände von deutschen Hochschulen.

Founded in 1898 [?].

ZWEIGVEREIN DER ZUCKERTECHNIKER FÜR DAS AUSLAND.

Founded at Berlin. In 1901: President, C. Huck.

DEUTSCHE ELEKTROCHEMISCHE GESELLSCHAFT.

Founded in October, 1894, at Berlin. In 1900: President, J. H. van't Hoff; members, about 700.

Publication: Bericht der deutschen elektrochemischen Gesellschaft, 1894–1900.

VEREIN DEUTSCHER CHEMIKER.

Founded in 1896 at Berlin, as successor to Gesellschaft für angewandte Chemie (1887). Its seat is the residence of the President for a given year. In 1900: President, H. Caro; honorary members, 4; members, 2271. Embraced in 1900 the following sections (Bezirk-Vereine): Aachen, Belgien, Berlin, Frankfurt, Hamburg, Hannover, Mittel-Franken, Mittel- und Niederschlesien, Oberrhein, Oberschlesien, Pommern, Rheinland, Rheinland-Westphalen, Saar, Sachsen-Anhalt, Sachsen-Thüringen, Württemberg.

Publication: Zeitschrift für angewandte Chemie, 1887–1900. *Cf.* Deutsche Gesellschaft für angewandte Chemie.

VERBAND SELBSTÄNDIGER ÖFFENTLICHER CHEMIKER DEUTSCHLANDS.

Founded May 30, 1896, at Nürnberg. In 1900: President, Robert Kayser; members, 161; associates, 102.

Publication: Zeitschrift für öffentliche Chemie (established in 1895), 1897–1900. Also Vol. I. as Vol. III., 1897, of Centralblatt für Nahrungs- und Genussmittel Chemie, sowie Hygiene.

GREAT BRITAIN.

SOCIETY FOR PHILOSOPHICAL EXPERIMENTS.

Founded in 1794 at London.

Publication: Minutes of the Society for Philosophical Experiments, 1794.

NOTE.—A German translation of the *Minutes* was edited by Alex. Nic. Scherer and published at Halle in 1803.

CHEMICAL SECTION OF THE BRITISH ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE.

Founded in 1831. This is, however, a corporate part of the British Association, and the papers read to the Section are published in the annual Reports of the British Association, 1831–1900. In 1900: President, W. H. Perkin, jun.; number of members not given.

Chemical Society of London.

Founded in 1841 at London. In 1900: President, T. E. Thorpe; honorary and foreign members, 33; members, 2300.

Publications: Memoirs and Proceedings of the Chemical Society of London (1841–48); Quarterly Journal, 1849–62; Journal of the Chemical Society, 1863–1900.

Society of Public Analysts.

Founded in 1874 at London. In 1900: President, Walter W. Fisher; honorary members, 9; members, 260.

Publication: Proceedings of the Society of Public Analysts, 1876; The Analyst, 1877–1900.

Institute of Chemistry of Great Britain and Ireland.

Founded October, 1877, in London; incorporated, 1885. In 1900: President, John Miller Thomson; members, fellows, and associates, 1008 (resident members, 904); students, 118. Total, 1126.

Publications: Proceedings, half yearly, 1878–1900; Register, yearly, 1878–1900; Regulations, yearly, 1878–1900.

Society of Chemical Industry.

Founded in 1881 at London. In 1900: President, Charles F. Chandler; honorary member, 1 (John Glover); members, 3459.

Publication: Journal of the Society of Chemical Industry, 1882–1900.

Note.—The Society has eight sections: London, Liverpool, Manchester, Newcastle, New York, Nottingham, Scotland, and Yorkshire.

Society of Dyers and Colourists.

Founded in 1884 at Bradford. In 1900: President, H. Grandage; honorary members, 3; members, 553.

Publication: Journal of the Society of Dyers and Colourists, 1884–1900.

Alembic Club.

Founded in 1889 at Edinburgh. This is a private club of only six members and has no president; the Secretary is Leonard Dobbin.

Publishes no journal, but has issued 15 Reprints of Chemical Monographs, etc., 1893–1900, and other works.

International Association of Leather-Trades Chemists.

Founded September, 1897, at London. In 1900: President H. R. Proctor; number of members, ——.

Publication: Report of the Proceedings of the Conference of Leather-Trades Chemists, 1897.

ITALY.

Associazione chimico-farmaceutica fiorentina.

Founded in 1877 at Florence. In 1900: honorary members, 20; resident members, 100.

Publication: L'Orosi, Bollettino di chimica, farmacia e scienze affini. Firenze, 1878–1900.

Società chimica di Milano.

Founded in February, 1895, at Milan. In 1900: President, Angelo Menozzi; resident members, 152; correspondents, 133.

Publication: Annuario della Società chimica di Milano, 1896–1900.

Associazione chimico-industriale di Torino.

Founded June 25, 1899, at Turin. In 1900: President, Vittorio Sclopis; honorary members, 4; resident members, 103; correspondents, 87.

Publication: La Chimica industriale, 1899–1900.

Società italiana dei chimici analisti.

Founded in 1893 at Pavia.

Publication: Atti ufficiale delle Società italiana dei chimici analisti, 1893. This forms a pamphlet of 18 pp. only, and is perhaps a mere prospectus, as the Society ceased to exist before 1900.

JAPAN.

Chemical Society of Tokyo.

Founded April, 1878, at Tokyo. In 1900: President, Naokichi Matsui; number of members, 156; associates, 197.

Publication: Tokyo Kagakkai Kaishi, 1880–1900.

Society of Chemical Industry of Japan.

Founded February, 1898, at Tokyo. In 1900: President, Takeaki Enomoto; honorary members, 7; members, 223; associates, 429.

Publication: Kōgyō Kagaku Zasshi, 1898–1900.

RUSSIA.

Russkago Khimicheskago Obshtchestva [Russian Chemical Society].

Founded October 26, 1868. The Chairman of the first meeting was D. Mendeléeff. In 1900: President, F. F. Petrushevsky; members, 327.

Publications: Zhurnal Russkago Khimicheskago Obshtchestva. St. Petersburg, 1869–72, 4 vols.

Continued as:

Zhurnal Russkago Khimicheskago Obshtchestva i Fisicheskago Obshtchestva, 1873–78. 6 vols.

Continued as:

Zhurnal Russkago Fisiko-Khimicheskago Obshtchestva, 1879–1900.

SOUTH AFRICA.

Chemical and Metallurgical Society of South Africa.

Founded May, 1894, at Johannesburg.

Publication: Proceedings of the Chemical and Metallurgical Society of South Africa, 1894–1897.

SWITZERLAND.

Société chimique de Genève.

Founded February 10, 1878, at Geneva. In 1900: President, F. Kehrmann.

Publication: The Minutes of the monthly meetings are published in: Archives des sciences physiques et naturelles de Genève, and in the Chemiker Zeitung.

Verein schweizerischer analytischer Chemiker.

Founded March 12, 1887, at Zürich. In 1900: President, A. Bertschinger; number of members, 94.

Publication: The organ of the Society is Schweizerische Wochenschrift für Chemie und Pharmacie, which was established under the title, Schweizerische Zeitschrift für Pharmacie, 1856–62.

UNITED STATES OF AMERICA.

CHEMICAL SOCIETY OF PHILADELPHIA.

Founded in 1792 at Philadelphia, under the presidency of James Woodhouse. Number of members unknown. The Society was in existence for more than ten years.

Publication: Memoir on the Supply and Application of the Blowpipe [etc.] by Robert Hare, 1802.

COLUMBIAN CHEMICAL SOCIETY OF PHILADELPHIA.

Founded August, 1811, at Philadelphia, under the presidency of James Cutbush. Honorary members, 69; junior members, 13.

Publication: Memoirs of the Columbian Chemical Society of Philadelphia. Vol. I., 1813.

CHEMICAL SECTION OF THE AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE.

A migratory organization, founded in 1875 as a Sub-Section; it became Section C of the A. A. A. S. in 1882 at the second meeting in Montreal. In 1900: Chairman of the Section, Jas. Lewis Howe; members, 89; fellows, 181.

Publications: The Proceedings of the A. A. A. S. has a division containing papers read before the Section of Chemistry.

AMERICAN CHEMICAL SOCIETY.

Founded April 20, 1876, in New York City. In 1900: President, William McMurtrie; honorary members, 10; members, 1546; associates, 123.

Publications: Proceedings of the American Chemical Society, 1877–78; Journal of the American Chemical Society, 1879–1900.

Note.—In 1900 the Society had 12 sections: Rhode Island, Cincinnati, New York, Washington, Lehigh Valley, Chicago, Nebraska, North Carolina, Columbus, North Eastern, Philadelphia, and Michigan.

ASSOCIATION OF OFFICIAL AGRICULTURAL CHEMISTS.

Founded September 8, 1884, at Philadelphia. In 1900: President, B. W. Kilgore; members, 350.

Publications: Methods of Analyses, 1884–88; Proceedings, 1889–1900.

NOTE.—Conventions of the Official Agricultural Chemists had been held prior to 1884; in 1880 at Washington and Boston; in 1881 at Cincinnati; and in May, 1884, at Atlanta.

Chemical Society of Washington.

Founded at Washington in 1884. In 1893 became the Washington Section of the American Chemical Society, retaining also its name as above. In 1900: President, H. Carrington Bolton; members, 114.

Publication: Bulletin of the Chemical Society of Washington, 1884–92.

New England Association of Chemistry Teachers.

Founded February 19, 1898. Meetings are held in New England. In 1900: President, Rufus P. Williams; honorary members, 8; active members, 50; associates, 22.

Publications: Circulars of Information and Reports, 1898–1900. Also Registers.

VICTORIA.

Society of Chemical Industry of Victoria.

Founded in 1900 under the Presidency of Orme Masson; membership, about 100.

ADDENDUM.

Société d'Arcueil.

Founded in 1807 at Arcueil. Dissolved in 1822. Members (at any one time), 12.

Publication: Mémoires de physique et de chimie. Paris, 3 vols., 8vo. 1807–17.

Note.—This private organization was founded by C. L. Berthollet; the meetings were held at his country house in Arcueil, near Paris. The membership included: La Place, C. L. Berthollet and his son A. B. Berthollet, Biot, Gay Lussac, Humboldt, Thénard, Decandolle, Collet-Descotils, Berard, Chaptal, Dulong, Poisson, Malus.

The foregoing list does not include Academies of science nor Associations of general science (with a few exceptions); it does not embrace societies having for their object industries involving chemical processes in part, excepting the refining of sugar; nor does it include the numerous societies of brewers and of beer-making, among which may be named the following:

BRAU-INDUSTRIE VEREIN IM KÖNIGREICH BÖHMEN, founded at Prague in 1874, and publishing the Böhmische Bierbrauer.

DEUTSCHE BRAUERBUND, founded at Nürnberg in 1861, and publishing the Allgemeine Hopfen-Zeitung.

WÜRTTEMBERGISCHE BRAUERBUND, founded at Waldsee in 1872, and publishing the Schwäbische Bierbrauer.

BADISCHE BRAUERBUND, founded at Nürnberg in 1876, and publishing the Hopfenlaube.

DEUTSCHE BRAUMEISTER VEREIN, founded at Berlin, 1887, and publishing the Deutsche Brau-Industrie.

ASSOCIATION GÉNÉRALE DES BRASSEURS BELGES, founded at Brussels in 1874, and publishing Revue des Bieres.

COUNTY BREWERS' SOCIETY, England, publishing since 1871 the Brewers' Guardian.